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FOOD PRESERVATION

A Textbook for Student, Teacher, Home-maker and Home Factory Operator

BY

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PREFACE

The steadily growing interest in the preservation of food in the home and on the farm in most sections of the country is the result of a combination of influences. The most significant of these are:

1. The tremendous emphasis placed upon food and food values during the World War and the dissemination of information on methods of procedure gave an impetus to home food preservation that has continued to the present time, and promises to continue for some time to come.

2. The awakened activity in home economics work dealing with foods is growing both in interest and in influence. This has been made possible because of research and because in the light of modern discoveries the food specialists have been able to present worth-while material. The newer knowledge of foods and nutrition is now not only taught in the public schools and in the colleges but is also carried to the home-maker by the extension specialist and the cooperating organizations.

3. The stimulation of research into methods of food preservation through the Purnell Act is opening a practically untouched field of scientific investigation.

4. The efforts being made by home-makers to adjust their home management to present-day knowledge with respect to food supply has induced many of them to practice food preservation as the most economical method of providing the necessary variety and quantity of proper foods for family needs. The average American home-maker is feeding her family more intelligently at the present time than ever before. The day in which "rule of thumb" methods controlled in the management of home affairs is rapidly giving way to the rational rule of cause and effect. The intelligent home-maker to-day is doing her work with the least possible expenditure of time and energy and finds not only greater enjoyment in the performance of the daily tasks but also more leisure for improvement and recreation.

5. The increasing demand on the part of consumers for high quality food products with the home-made taste and flavor has resulted in the development of many small home factories to supply this demand. These have proven profitable and in order to extend their activities and to improve their output the operators of these small plants are constantly seeking better methods.

6. The producer of fruits and vegetables is awakening to the fact that too much produce while sound and wholesome does not find a ready sale as fresh material or if in demand the price is too low to allow a profit. Most of these grades of products are suitable for manufacturing into nutritious foods, and many of these growers are looking to some one to supply them with simple and inexpensive methods of salvaging these low market grades.

If this book can help to sustain and to increase the interest in food preservation on the farm and in the home, and if it can simplify present-day methods and add to their safety, it will have satisfied the hopes and wishes of the author.

The author has tried to write a book such as he believes would have been most useful to him at the time he began teaching food preservation to college students. At the risk of being tedious, possibly boresome in places, much detail of principles and operations is given. Too often the lack of a simple detail spoils the entire batch. Everyone of course knows the old legend, " For lack of a nail a kingdom was lost."

The greater emphasis is given to the practical rather than to the strictly scientific phase. This treatment does not, however, exclude a discussion of the "why" as well as the "how" of principles and methods, which are essential to an intelligent application. Those who desire a more thoroughly scientific treatment or who wish other viewpoints on practical methods are requested to make a study of the references given at the end of each chapter.

The material included here is largely the result of fifteen years of teaching the subject together with sufficient extension work to familiarize the author with the major problems of the teacher, the home-maker, and the home factory operator.

This book is presented with the sincere hope that it may prove stimulating and helpful to all those interested in food preservation whether student, teacher, home-maker or factory operator.

AMHERST, MASSACHUSETTS
January, 1930

W. W. CHENOWETH.

CONTENTS

FOOD PRESERVATION

CHAPTER I

FOODS

Foods may be defined as any substance which when introduced into the digestive tract will, under normal conditions, contribute to the growth and repair of the body or will produce energy. Foods may also be stored in the body in the form of fat.

The student of food preservation is interested in foods from the four following viewpoints:

I. Keeping quality.
II. Spoilage and its causes.
III. Methods of preservation and
IV. Food values or nutrition.

I. KEEPING QUALITY

From the standpoint of keeping quality foods and food materials are classified as (*a*) perishable, (*b*) semi-perishable and (*c*) non-perishable.

(*a*) *Perishable.*—Foods and food materials belonging to this group are characterized by: Immaturity, as asparagus, string beans, sweet corn, etc., or by being soft and juicy as, tomatoes, peaches, berries, grapes, etc., and all meats, poultry and sea foods.

(*b*) *Semi-Perishable.*—These foods and food materials are more matured or less juicy than those in the preceding group. With proper handling they may be kept for weeks or even many months without serious deterioration. Common examples of this group are potatoes, the root crops such as turnips, beets, carrots, etc., and late maturing apples and pears.

(*c*) *Non-Perishable.*—This group includes those food materials that have been brought to maturity and that by natural ripening processes have had their water content reduced to a very small amount. These are the grains, cereals, beans, peas, etc.

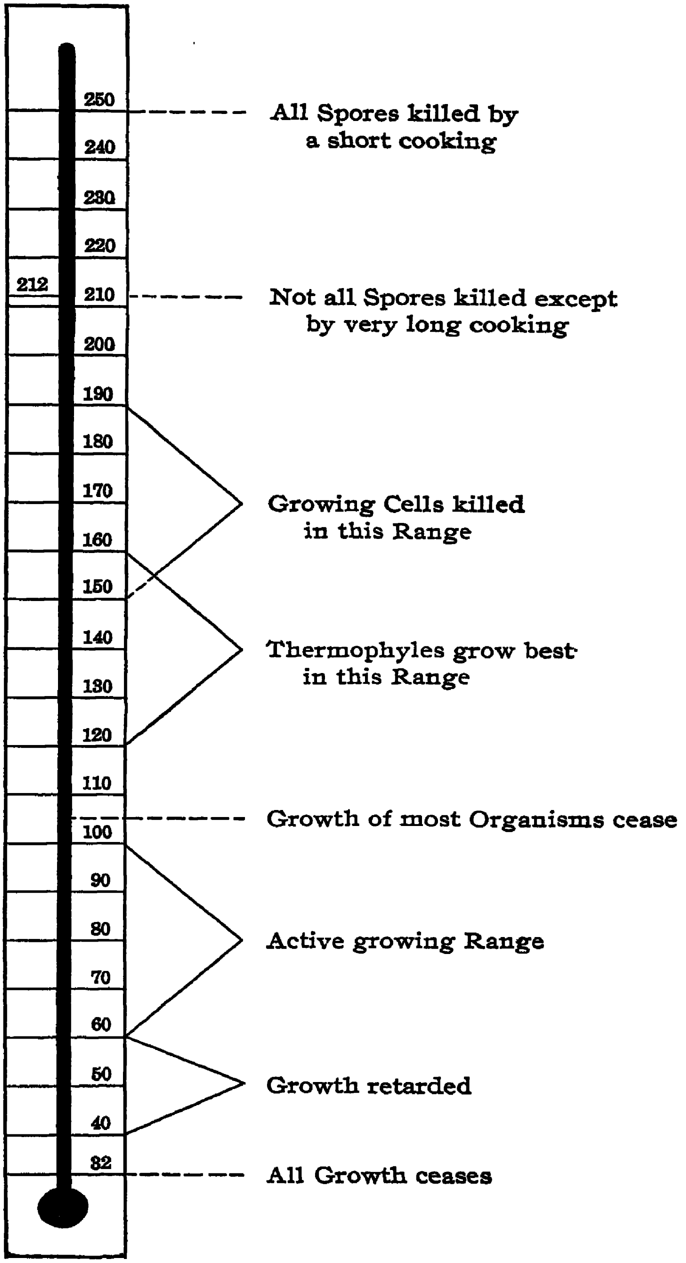
II. SPOILAGE AGENTS

The perishable and semi-perishable foods spoil because of chemical and physical changes brought about in them through the activity of some one or more of the following groups of spoilage agents: (*a*) molds, (*b*) yeasts, (*c*) bacteria, (*d*) enzymes. The first three of these groups are living organisms, and the enzymes are chemical substances. Under proper conditions of temperature and air supply the various members of these groups attack certain compounds in food materials and convert them into other compounds which render the food unfit for human consumption.

(*a*) *Molds.*—This group of spoilage agents is familiar to every one since they are visible to the unaided eye and are therefore a very common sight. They usually begin their growth upon the surface of a food material, later sending into the food their growing filaments and forming the customary fuzzy-like growth on the surface which carries the various colored spore-producing organs. Molds thrive best in damp places. Absence of bright light and presence of stagnant air are aids to their most rapid growth. They require moisture, a suitable food, air, and a moderate amount of heat. Since molds grow readily in the presence of acids all fruits and fruit products are especially attacked by them, unless proper protection is given. Molds are quite easily killed by heating. A very few minutes' boiling or a temperature below the boiling point sufficiently prolonged will destroy them. Then if the food is protected from further contamination it will be free from subsequent attacks of these organisms. Molds, however, play an important rôle in the manufacture of some of our foods such as cheese.

(*b*) *Yeasts.*—The yeasts are microscopic in size, and most of us are acquainted with them through what they accomplish. They are useful in many of the household arts and in the manufacture of vinegar. They are responsible for practically all fermented fruits and fruit products. They require air, food (sugars), and at least a moderately warm temperature for growth. They are readily killed by heating, being less resistant to high temperatures than are some of the molds. They are concerned primarily in the spoilage of canned fruits and fruit products.

(*c*) *Bacteria.*—The bacteria as a group are much more resistant to heat than are the yeasts and molds, and their control is therefore the canner's biggest problem. They grow best in a non-acid medium. They readily succumb to the influence of heat in the presence of acids; consequently they offer no serious problem in the canning of acid fruits and vegetables. It is the non-acid foods that are the most difficult to preserve and this is due to the activities of bacteria.



—Courtesy of The Glass Container

Fig. 1.—The effect of temperature upon spoilage organisms.

Many bacteria exist in two forms, the growing or vegetative, and the resting or spore form. Practically all the active bacteria are controlled by a temperature of boiling water (212° F.) if prolonged for a few minutes. But the spores of some species can withstand the action of boiling water (212° F.) for many hours. This resistance of the spores is the chief cause of the canner's troubles.

All of these resistant forms have a wide distribution and the canner must always assume that they may be present on either the raw materials or containers or both, and the process for preserving the food must be such as to control these bacteria.

(*d*) *Enzymes.*—These are chemical substances which by their presence induce chemical changes while they themselves remain unchanged. They occur naturally in all organic materials. They are soluble in water and are most effective at a temperature range of 80° to 110° F. When heated to 212° F. for a short time they become inactive. These are the agents that change the unripe fruit to ripe fruit and eventually if allowed to continue their activity the fruits become stale. They are more likely to cause trouble with canned fruits than any other food due to the low temperatures to which fruits are heated during processing. They are active only in the presence of free oxygen. Hence a thorough exhaust of containers helps to protect the food against this type of spoilage.

Effects Produced by Spoilage Agents

Some of the common effects produced by the micro-organisms and enzymes which bring about the spoiling of canned foods may be of interest alike to consumer and canner.

Molds.—The effects of mold action upon foods are too well known to need extended comment here. Molds attack practically all kinds of foods provided suitable moisture and temperature conditions prevail. If the mold is present in small amounts it may, as a general rule, be removed together with the part of food to which it adheres, leaving the remainder palatable and wholesome. A small fleck or two of mold is often seen on the syrup of fruits canned in glass. These small bodies may be removed and the food eaten with safety. A heavy growth of mold, however, will affect the taste, flavor and texture. Such foods should be discarded.

Yeasts.—Yeasts are particularly concerned with the fermentation of fruits and fruit products. Fermented products have acquired a foreign taste and flavor and their food value has been seriously impaired. Such foods should be discarded. One of the products of fermentation

is carbon dioxide. This gas causes the tin can to swell and by this gas the glass container is either broken or its seal is opened, allowing some of the liquid to leak out.

Bacteria.—Bacteria, as has been said, confine their activities mainly to the non-acid foods. The result is the formation of a large number of products and conditions, among which are:

(*a*) *Gases.*—Some bacterial actions cause the evolution of gases, among them carbon dioxide and hydrogen, which not being readily soluble develop a pressure in the container. In tin cans the ends are pushed out giving the familiar "swell." In glass the seal is opened causing leakage or the container is broken. Other gases such as hydrogen sulphide and ammonia are highly soluble. These go into solution in the liquids in the container and their presence is detected only by their peculiar odor when the containers are opened.

(*b*) *Acids.*—Another group of bacteria produce acids which give the familiar "flat sour," so called because the ends of the spoiled cans remain flat. The presence of this type of spoilage is recognized readily by the acid taste of the foods. Much of this type of spoilage takes place at a temperature ranging from 110° to 150° F. (see page 3). This fact explains the desirability of cooling quickly after containers are removed from the processer. It is also the reason why packed foods, if hot, should not be allowed to stand too long before they are processed. It also suggests cool storage of canned food until consumed.

(*c*) *Turbidity.* Some bacteria cause the liquid to become turbid or cloudy. This condition is readily seen in glass jars but may be detected in tin cans only when they are opened. This is one of the difficult types of spoilage to recognize, since other causes such as overprocessing or excess of starch or some minerals in the raw materials may give a very similar appearance. Turbidity may be an indication of spoiled foods but not necessarily proof that the food is spoiled. Usually microscopic examination is necessary to detect the difference.

(*d*) *Odors and Flavors.*—Various odors and flavors other than those already named are produced as a result of bacterial action on canned foods. The presence of any foreign odor or flavor should be sufficient to condemn the package of food as unfit for consumption.

(*e*) *Toxins.*—Some bacteria through their activity produce substances that are deadly poisons. These are referred to as toxins. Often the presence of such toxins is not discovered until some of the food has been consumed. Unfortunately the presence of the most deadly of these may not be detected by casual observation. The only safeguard against the possible presence of these poisons is the boiling of the canned vegetable in an open vessel (since they are most commonly

found in canned vegetables) for several minutes. The heat breaks the poisonous compound into simpler and harmless substances, rendering the food wholesome. Fortunately for both canner and consumer such toxins occur very rarely in canned foods.

Enzymes.—The most noticeable effect of enzyme action on canned foods is the change in color; first noticed at the top of the jar as it stands on the shelf. The foods first turn brown and if action continues for any length of time the color deepens to black. Only the upper pieces may be affected, or the entire package may be spoiled. If badly discolored, the quality of the food is very low; slight browning will affect the taste and flavor only.

III. PRESERVATION OF FOOD

Foods are preserved, that is, their deterioration is checked or prevented, by the application of some means which checks or prevents the activity of spoilage agents. Preservation in its general meaning may be either short-time or long-time. If short-time the means applied will preserve the food for a few days only, if long-time the food will retain its useful qualities throughout a period of many months. It is this last phase of food preservation that is of interest to the student, the homemaker and the operator of the small factory. There are many methods used to control the action of spoilage agents. Among those of most importance are the following:

1. Storage.—Two types of storage are in use, common or cellar storage and refrigerated or cold storage.

Common Storage.—This is effective only in a cool climate. Its efficiency depends upon temperature and humidity. Low temperature is necessary to slow down the activity of spoilage agents, and relatively high humidity prevents drying or shriveling. This type of storage is used primarily in the home and on the farm. It is effective in holding apples and root crops through the winter season. The perishable foods may be held for only a few hours in common storage.

Cold Storage.—Cold storage possesses many advantages over common storage. The temperature and humidity are both under control and conditions suitable for holding any food material may be maintained indefinitely independent of climate or weather conditions.

Many of the perishable foods may be kept for a few days to a few weeks at a temperature above freezing, and the semi-perishable fruits and vegetables are held through the season at temperatures above freezing.

Storage at temperature below freezing was formerly confined to

meats, poultry and sea foods. Within comparatively recent years, however, many of the fruits such as berries, cherries and peaches have been stored at these low temperatures. As a rule this fruit is treated with sugar before being placed in cold storage. This practice is on the increase and "cold-packed" fruit is rapidly becoming available not only for the commercial manufacturer of fruit products and for ice cream making but also for consumption in the home.

Foods and food materials keep in cold storage because the low temperature either checks or stops all action of spoilage agents.

2. Canning.—Canning is the preservation of food in hermetically sealed containers, the preservation being effected by the application of heat. The ideal toward which the canner strives is a sterile package, that is, a package in which all yeasts, molds, and bacteria have been destroyed. In case the package is not sterile then the environment created by the canning process must be such that all spoilage agents remain inactive. The heat destroys or renders inactive all living organisms and the hermetic seal prevents contamination from sources outside the container.

3. Drying or Evaporation.—Many foods and food materials may be preserved almost indefinitely by removing a sufficient amount of their water content. Moisture is necessary to the activity of all spoilage agents. If, therefore, the moisture content of foods can be kept below the minimum required for active growth, the foods will keep.

4. Manufacturing.—In the manufacture of many fruit products the sugar concentration reaches such a high degree that all growth of spoilage organisms is stopped. In the case of some vegetables the use of salt and acids has a similar effect. Meats are preserved by a combination of drying, salt, smoke, etc. In those cases where sugar or salt functions, the preservation is due largely to loss of moisture by spoilage organisms through osmosis.

5. Fermentation.—In the manufacture of kraut, pickles, and pickled vegetables, preservation is effected by the fermentation of the sugars into lactic acid and by the presence of salt. Surface protection against mold growth must be given. Bacteria are controlled by the lactic acid present and control is aided by the fact that since the sugars have been broken down there is no food available for the yeasts.

6. Preservatives.—When certain substances are added to foods or food materials in sufficient quantities they create an environment unfriendly to the growth of spoilage organisms. Such substances are called preservatives. Some of these preservatives function through osmosis; some function by creating an acid medium; others through their essential oils. The common preservatives are sugar, salt, vinegar,

and spices. Those commonly thought of as chemical preservatives are benzoate of soda, salicylic acid, sodium sulphite, sulphur dioxide, saltpeter, and borax.

Rarely if ever will the home-maker or home factory operator resort to the use of the so-called chemical preservatives except possibly in the case of the cider manufacturer who uses benzoate of soda to prolong the keeping of fresh cider.

IV. NUTRITION

With regard to their value in nutrition, foods are classified as: (1) Body builders, (2) Energy givers, and (3) Regulators.

1. Body Builders.—These are the foods that produce growth and keep the body in a state of repair. The most important of these are proteins, water, and minerals. The proteins go to build the muscles, skin, connective tissue, and blood serum. They are found in greatest abundance in lean meat, milk, eggs, poultry, fish, nuts, peas, beans, and the cereals. Excess of protein food in the diet is oxidized to produce energy or in some instances the excess may be stored as body fat. As a source of energy, proteins are expensive since they yield the same amount of energy—116 calories per ounce—as do the much cheaper carbohydrates. Water is essential to the structure of practically all parts of the body. Of the minerals the most important are: *calcium* for the bones and teeth, *iron* for the blood corpuscles and *phosphorus* for the bones and nerve tissue. These minerals are found in greatest abundance in meats, poultry, fish, fresh and dried fruits, peas, beans, and the leafy vegetables.

2. Energy Foods.—These are the foods which are oxidized to produce energy. The energy thus produced manifests itself in maintaining the body heat, in all voluntary and involuntary muscular action, and in all glandular activity. The foods used primarily for this purpose are the carbohydrates and fats. Proteins, as stated, may be oxidized for energy. Excess carbohydrates and fats may be stored as body fat.

(*a*) *Carbohydrates.*—This group comprises the sugars, starches, and cellulose. The invert sugars are assimilated without digestion. Sucrose and starches are changed by digestive processes to invert sugars before absorption into the blood stream. When oxidized in the body they set free 116 calories per ounce. The carbohydrates are found most abundantly in cereals, fruits, potatoes, peas, and beans.

(*b*) *Fats.*—This class of foods occurs both in the vegetable fats and oils and in animal fats. They possess a higher energy value than carbohydrates. One ounce will release 264 calories. Fats occur in con-

nection with most animal flesh, whole milk, cream. butter, and nuts.

3. Body Regulators.—This group includes a large number of substances of which the more important ones are various organic acids and salts, water, and vitamins.

(*a*) *Acids and Salts.*—These play an important part in the digestion and assimilation of food. They are found in many of the fruits and vegetables.

(*b*) *Water.*—Water is required to maintain the necessary liquid condition of the various fluids of the body, to function in equalizing the body temperature, and to aid in the removal of waste materials.

(*c*) *Vitamins.*—The vitamins function in a variety of ways. Each group having its own special work.

Vitamin A.—Promotes growth, protects against a certain disease of the eye, and increases resistance to infectious diseases. This is the fat, soluble vitamin and is found in greatest abundance in cod liver oil, butter, whole milk, cream, and eggs.

Vitamin B.—Promotes general health and protects against the specific disease beri beri. Also stimulates the appetite. Found in abundance in tomatoes, citrus fruits, most vegetables and native fruits, and cereals and milk.

Vitamin C.—Prevents scurvy and promotes proper growth of teeth. Found in quantity in tomatoes, citrus fruits, rutabagas, and leafy vegetables.

Vitamin D.—Prevents or tends to prevent rickets. Found in abundance in cod liver oil and egg yolk.

The accompanying food chart, which is published by permission of the American National Red Cross Society, is one of the most comprehensive and complete of its kind. The student, dietitian, and homemaker will find it a ready and reliable guide in their quest for actual or relative food values. A careful study of this food chart will reveal the value of a storage room well stocked with canned and manufactured foods.

INTERPRETATION OF THE FOOD CHART AND SUGGESTIONS FOR ITS USE

In making use of the food chart the following points must be kept in mind:

1. In general the values for each *serving* given are estimated upon the basis of the food material itself without added seasonings. When such materials as sugar or fat have been added in preparing a food the values for these must, of course, be estimated along with those of the original food. For example—sugar added to fresh fruit must be accounted for by itself.

2. The *energy value* of the protein, fat and carbohydrate of the different foods

CHART I.—FOOD VALUE OF AN AVERAGE SERVING OF CERTAIN FOOD MATERIALS

(Interpretation of Chart and Suggestions for Its Use Will be Found on Page 9.)

Name of Food	Approximate Amount of One Serving				Growth and Health Factors													
					Energy Factors						Regulatory Factors							
					Distribution of Calories and Grams						Tissue Building Factors: Percentage of the Total Daily Requirement for an Average Adult				Relative Distribution of Vitamins		
	Measure	Weight		Total Calories	Protein		Fat		Carbohydrate		Protein	Calcium	Phosphorus	Iron	A	B	C
		Oz.	Gm.		Cal.	Gm.	Cal.	Gm.	Cal.	Gm.	Per Cent						
Milk and Milk Products:																	
Milk, whole	½ pt.	8½	240.9	170	34	8.5	88	9.7	48	12.0	11.5	43.5	17.2	3.9	+++	++	+
Buttermilk	½ pt.	8⁴/₅	249.5	89	29	7.2	12	1.3	48	12.0	10.6	38.5	18.3	4.1	+	++	+
Cheese, American	Cube 1 in.	⅔	18.9	89	23	5.7	63	7.0	3	0.7	7.7	27.7	10.5	1.8	++	*	*
Cheese, cottage	3⅔ T.	2	56.7	62	49	12.2	2	0.2	11	2.7	17.4	8.4	14.0	.....	+	*	*
Cream, thin	2 T.	1	28.3	50	2	0.5	43	4.7	5	1.2	0.9	3.7	1.7	0.3	+++	++	+
Butter	Pat 1 T.	½	14.1	100	1	0.2	99	11.0	.....	.....	0.2	0.3	0.1	0.2	+++	−	−
Ice cream	⅔ C.	5	141.7	320	13	3.2	202	22.4	105	26.2	3.2	13.0	5.9	1.2	++	++	+
Fat and Salad Oils:																	
Animal fat	1 T.	²/₅	11.3	100	.....	.....	100	11.1	.....	.....	.....	.....	.....	.....	+	−	−
Olive oil	1 T.	²/₅	11.3	100	.....	.....	100	11.1	.....	.....	.....	.....	.....	.....	−to+	−	−
Cottonseed oil	1 T.	²/₅	11.3	100	.....	.....	100	11.1	.....	.....	.....	.....	.....	.....	?	−	−
Bread and Cereals:																	
Bread, white	1 slice 3×3½×½ in.	⅔	18.9	50	7	1.7	3	0.3	40	10.0	2.5	0.8	1.3	1.2	?	+	−
Graham bread	1 slice 3¼×2×⅔ in.	½	14.1	33	5	1.2	2	0.2	26	6.5	1.6	1.0	2.1	2.1	+	++	?
Boston brown bread	½ in. slice, 3 in. diam.	1¹/₅	34.0	67	7	1.7	6	0.6	54	13.5	2.5	5.5	4.1	5.7	*	*	*
Bran, wheat	¼ cup	³/₅	17.0	54	8	2.0	3	0.3	43	10.7	2.8	3.1	16.3	9.2	+	++?	−
Corn meal, cooked	⅔ cup	6	170.1	100	10	2.5	5	0.5	85	21.2	3.7	0.7	4.0	2.0	−to+	++	−

Hominy grits, cooked...	½ cup	4¾	134.6	70	6	1.5	1	0.1	63	15.7	2.3	0.2	1.4	1.2	*	−to+	*
Macaroni, cooked.......	½ cup	2³/₅	73.7	50	7	1.7	1	0.1	42	10.5	2.6	0.4	1.5	1.1	*	*	*
Oatmeal, cooked.......	⅔ cup	5¼	148.8	67	11	2.7	11	1.2	45	11.2	4.0	1.6	5.0	4.3	−to+	++	−
Rice, brown, steamed...	¾ cup	4	113.4	100	10	2.5	7	0.7	83	20.7	3.6	0.4	4.5	3.9	+	++	−
Rice, white, steamed....	¾ cup	4	113.4	100	9	2.9	1	0.1	90	22.5	3.2	0.1	2.0	1.7	−	−	−
Eggs:																	
Egg, whole, in shell.....	1 egg	2½	70.8	70	25	6.2	45	5.0	.....	.....	9.0	4.6	6.5	9.5	++	+	−
Egg, white............	1	1	28.3	14	13	3.2	1	0.1	.....	.....	4.8	0.4	0.2	0.2	−	*	−
Egg, yolk............	1	³/₅	17.0	56	11	2.7	45	5.0	.....	.....	3.4	3.0	5.0	8.6	+++	++	−
Meat, Fish and Poultry:																	
Bacon, cooked.........	4–5 small slices	½	14.1	100	13	3.2	87	9.6	.....	.....	4.6	0.3	2.6	3.2	−to+	+	?
Beef, lean, round, broiled	2 slices, 4×3×1⅛ in.	4	113.4	200	96	24.0	104	11.5	.....	.....	34.2	2.0	19.6	24.0	−to+	+	−to+
Chicken, roast.........	1 slice, 4×2½×¼ in.	1⅔	47.2	100	51	12.7	49	5.4	.....	.....	18.2	1.0	10.4	12.7	−to+	+	*
Fish, lean, broiled......	1 slice, 4×2¼×1 in.	4	113.4	133	81	20.2	52	5.7	.....	.....	28.9	3.2	17.6	7.4	−to+	++	*
Ham, boiled..........	1 slice, 4¾×6×⅛ in.	2	56.7	150	44	11.0	106	11.7	.....	.....	15.7	0.9	8.9	11.0	−to+	+	−
Lamb, chop, broiled....	1 chop	1³/₅	45.3	100	40	10.0	60	6.6	.....	.....	14.2	0.9	8.1	10.0	*	+	*
Lamb, roast..........	1 slice, 3½×4½×⅛ in.	1⁴/₅	51.0	100	41	10.2	59	6.5	.....	.....	14.6	0.9	8.4	10.2	*	+	*
Liver, calves, broiled....	Medium size serving	2⁴/₅	79.3	100	62	15.5	38	4.2	.....	.....	22.1	1.3	12.6	15.5	++	++	+
Mutton, roast..........	1 slice, 3×3¾×⅛ in.	1¹/₅	34.0	100	33	8.2	67	7.4	.....	.....	11.7	0.7	6.7	8.2	−to+	+	?
Oysters, raw..........	½ cup	5²/₅	153.0	75	37	9.2	18	2.0	20	5.0	13.2	11.7	17.4	44.6	+	++	+
Pork chop, lean, broiled.	1 chop	2²/₅	68.0	200	64	16.0	136	15.1	.....	.....	23.0	1.4	13.1	16.1	−to+	++	−
Veal leg, lean, broiled...	1 serving	4⅓	122.8	150	105	26.2	45	5.0	.....	.....	37.4	2.2	21.2	26.1	−to+	+	*
Vegetables:																	
Asparagus............	4 stalks 4 in. long	1½	42.5	10	3	0.7	1	10.1	6	1.5	1.1	1.8	1.3	3.0	+to++	+++	*
Beans, Lima, dried.....	¼ cup	2	56.7	200	42	10.5	8	0.8	150	37.5	16.6	5.9	14.5	26.7	*	*	*
Beans, Lima, fresh......	½ cup	3	85.0	100	23	5.7	5	0.5	72	18.0	8.2	2.9	8.3	11.0	*	*	*
Beans, dried †..........	¼ cup	1¾	49.6	171	45	11 2	8	0.8	118	29.5	15.9	11.8	17.7	23.1	+	+++	*
Beans, string, fresh.....	⅓ cup	1⅓	37.8	15	3	0.7	1	0.1	11	2.7	1.2	2.4	1.4	2.7	++	++	++
Beets................	⅓ cup cubes	2	56.7	25	3	0.7	1	0.1	21	5.2	1.2	2.4	1.6	2.2	+	+	+
Cabbage, chopped......	½ cup	1⅛	31.9	10	2	0.5	1	0.1	7	1.7	0.7	2.1	0.7	2.3	+to++	++	+++
Carrots, cooked........	2 medium	4	113.4	40	4	1.0	2	0.2	34	8.5	1.4	7.3	3.0	3.5	++	+	+
Cauliflower...........	1/₅ small head	2⅓	66.1	20	5	1.2	3	0.3	12	3.0	1.7	11.9	3.0	2.6	+	++	+
Celery...............	¼ cup	1¹/₅	34.0	6	2	0.5	.....	.....	4	1.0	0.1	3.7	3.8	1.1	−to+	++	*
Corn, fresh...........	1 ear 6 in.	4½	127.6	50	6	1.5	4	0.4	40	10.0	2.2	0.4	3.9	2.6	+	++	−
Corn, canned..........	½ cup	3³/₅	102.1	100	11	2.7	11	1.2	78	19.5	4.4	0.8	7.7	5.3	*	*	*

* Compiled from various sources. Rose, Laboratory Manual. Rose, Feeding the Family. Sherman, Food Products, and others.

† Dry beans are seen to be quite low in Vitamin C, the "anti-scorbutic" vitamin. However, sprouted beans contain it. The following directions for managing the sprouting of beans are furnished by the Bureau of Home Economics, U. S. Department of Agriculture. In this case Chinese (Mung) beans were used but more common varieties have been found satisfactory. Soak overnight the beans to be sprouted. The next morning place them in a colander or other container having holes for drainage. Keep them covered and in a warm place. Flood with warm water at least four or five times daily. They will sprout in from three to five days. The outer covering of the beans can then be removed by washing. The sprouts are good either raw or cooked and combine well with most vegetables. Naturally the sprouts are as perishable as any fresh vegetable and should be grown only as needed.

CHART I.—FOOD VALUE OF AN AVERAGE SERVING OF CERTAIN FOOD MATERIALS—*Continued*

Name of Food	Approximate Amount of One Serving				Growth and Health Factors													
					Energy Factors						Regulatory Factors							
											Tissue Building Factors				Relative Distribution of Vitamins		
					Distribution of Calories and Grams						Percentage of the Total Daily Requirement for an Average Adult						
	Measure	Weight		Total Calories	Protein		Fat		Carbohydrate		Protein	Calcium	Phosphorus	Iron	A	B	C
		Oz.	Gm.		Cal.	Gm.	Cal.	Gm.	Cal.	Gm.	Per Cent						
Vegetables (*continued*):																	
Cucumber	2/5 cucumber 7 in. long	3¾	106.3	16	3	0.7	2	0.2	11	2.7	1.0	2.1	2.3	1.2	−to+	+	++?
Dandelion greens	½ cup	4⅓	122.8	75	12	3.0	11	1.2	52	13.0	4.2	19.0	6.6	22.0	++	++	+
Lentils, dried	3¾ T.	1½	42.5	150	44	11.0	4	0.4	102	25.5	15.8	6.8	14.3	24.7	+	++	−
Lettuce	¼ head	2⅓	66.1	12	3	0.7	2	0.2	7	1.7	1.1	4.0	2.0	6.3	+to++	++	+++
Okra	5 to 6 pods	2	56.7	20	3	0.7	1	0.1	16	4.0	1.1	6.6	0.8	.....	*	++	*
Onions	3 to 4 medium	7¹/₅	204.1	100	13	3.2	6	0.6	81	20.2	4.7	10.1	7.0	6.7	−to+	+	++
Parsnips	½ cup slices	3	85.0	50	5	1.2	3	0.3	42	10.5	1.8	6.6	4.4	3.0	−?	++	*
Peas, dried	⅜ cup	2⁴/₅	79.3	253	70	17.5	6	0.7	177	44.2	25.0	9.7	23.0	27.8	+	++	?
Peas, fresh	⅜ cup	1¾	49.6	50	14	3.5	2	0.2	34	8.5	5.0	1.9	4.8	5.7	++	++	+++
Potatoes, white, boiled 15 min.	1 medium	3³/₅	102.0	100	11	2.7	1	0.1	88	22.0	3.8	2.3	5.2	10.4	+	++	++
Potatoes, sweet, baked	1 medium	6	170.1	200	12	3.0	10	1.1	178	44.5	4.1	4.7	5.6	5.4	++	++	*
Rutabaga, raw	2/5 cup	2	56.7	17	2	0.5	1	0.1	14	3.5	0.8	4.6	1.8	.....	−to+	++	++
Spinach, cooked	⅝ cup	5¼	148.8	25	3	0.7	2	0.2	20	5.0	3.1	10.3	5.4	25.1	+++	+++	+
Squash, cooked, summer	½ cup	3⅞	109.8	55	4	1.0	5	0.5	46	11.5	2.4	3.2	1.4	4.8	++	*	*
Tomatoes, fresh	1 small	3⁴/₅	107.7	25	4	1.0	4	0.4	17	4.2	1.4	1.8	2.1	2.9	++	++	+++
Turnips, cubes, raw	½ cup	2¼	63.8	25	3	0.7	1	0.1	21	5.2	1.2	5.9	2.2	2.1	−to+	++	++

Fruits, Fresh:																	
Apples	½ large	3¾	106.3	50	2	0.5	3	0.3	45	11.2	0.4	0.9	0.7	1.6	+	+to++	+
Banana	1 medium	4⅓	116.9	75	4	1.0	4	0.4	67	16.7	1.4	1.0	1.8	3.0	+?	+to++	+
Blackberries	½ cup	6	170.1	100	9	2.2	16	1.8	75	18.7	3.2	4.2	4.4	6.9	*	*	*
Cantaloupe	½ melon	9	255.1	50	3	0.7	....	....	47	11.7	1.1	3.2	1.4	2.4	+to++	++	*
Cherries, stoned	¼ cup	1⅛	31.9	25	1	0.2	2	0.2	22	5.5	0.4	0.9	0.7	0.8	+	*	+
Cranberries, fresh	½ cup	2	56.7	25	1	0.2	3	0.3	21	5.2	0.3	1.4	0.5	2.1	*	*	+
Grape fruit	½ large	7½	212.6	100	7	1.7	4	0.4	89	22.2	1.6	5.9	2.7	3.9	+	++	++?
Grapes, white	22	3⅔	103.9	100	5	1.2	15	1.6	80	20.0	1.9	2.8	2.4	2.1	*	+	+
Huckleberries	½ cup	2⅓	66.1	50	2	0.5	4	0.4	44	11.0	0.6	2.0	0.4	4.0	*	*	*
Lemon juice	1 T.	½	14.1	5	....	....	....	....	5	1.2	....	0.4	....	....	+	++	+++
Olives, green	4 medium	⅘	22.6	50	1	0.2	41	4.5	8	2.0	0.3	3.0	0.1	3.2	*	*	*
Oranges	1 medium	7⅛	202.0	75	5	1.2	2	0.2	68	17.0	1.7	9.7	2.3	1.9	+	++	+++
Orange juice	¼ cup	4	113.4	50	....	....	....	....	50	12.5	1.0	4.9	1.4	1.5	+to++	++	+++
Peaches	3 medium	10½	297.6	100	6	1.5	3	0.3	91	22.7	2.4	5.6	4.3	4.9	+	+to++	++
Pears	2 medium	6⅓	179.5	100	4	1.0	6	0.7	90	22.5	1.3	3.5	3.1	3.1	*	+	+
Pineapple	2 slices 1 in. thick	8⅕	232.4	100	4	1.0	6	0.7	90	22.5	1.3	6.0	4.8	7.7	+	+	++
Plums	3–4 large	4⅖	124.7	100	5	1.2	....	....	95	23.7	1.7	3.5	2.9	3.9	*	*	*
Raspberries	⅓ cup	1¾	49.6	33	3	0.7	5	0.5	25	6.2	1.2	3.6	1.9	2.0	*	*	++
Rhubarb	1 cup	3⅘	107.7	25	2	0.5	7	0.8	16	4.0	0.9	6.9	2.5	7.2	*	*	+
Strawberries	⅔ cup	4½	127.5	50	5	1.2	7	0.8	38	9.5	1.8	7.6	2.7	6.8	*	+	++
Fruits, Dried:																	
Apricots	9 halves	1⅓	38.8	100	7	1.7	3	0.3	90	22.5	2.7	3.4	3.3	3.5	*	*	*
Dates, unstoned	3–4	1	28.3	100	2	0.5	7	0.8	91	22.7	0.8	2.8	1.2	5.7	*	*	*
Figs	3 large	2⅕	62.3	200	10	2.5	2	0.2	188	47.0	3.8	15.0	5.6	12.7	*	*	*
Prunes	4 medium	1⅖	39.6	100	3	0.7	....	....	97	24.2	1.0	2.6	2.6	6.7	++	++	–
Raisins	¼ cup	1	28.3	100	3	0.7	9	1.0	88	22.0	1.0	2.8	2.9	9.3	–	+	–
Nuts:																	
Almonds	12–15 nuts	½	14.1	100	13	3.2	76	8.4	11	2.7	4.6	5.4	5.4	4.0	+	++	*
Peanuts	20–24 single nuts	⅗	17.0	100	19	4.7	63	7.0	18	5.4	6.7	1.9	5.5	2.4	+	++	*
Pecans	12 meats	½	14.1	100	5	1.2	87	9.7	8	2.0	1.8	1.8	3.4	2.3	+	+	*
English walnuts	8–16 meats	½	14.1	100	11	2.7	82	9.1	7	1.7	3.7	1.9	1.1	2.0	+	++	*
Sugar and Sweets:																	
Sugar	1 T.	⅖	11.3	50	....	....	....	....	50	12.5	....	....	....	....	–	–	–
Honey	1 T.	1	28.3	100	1	0.2	....	....	99	24.7	0.2	0.3	0.4	2.0	–	+	–
Maple syrup	2 T.	1⅗	45.3	133	....	....	....	....	133	33.2	....	7.2	0.3	8.9	*	*	*
Molasses	2 T.	1⅗	45.3	133	4	1.0	....	....	129	32.2	1.6	14.5	1.5	22.6	*	+	*
Corn syrup	1¾ T.	1½	42.5	100	....	....	....	....	100	25.0	....	....	....	....	*	*	*
Gingerbread, plain	Piece, 1×1¾×2 in.	2⅕	62.3	200	14	3.5	42	4.7	144	36.0	6.0	11.5	3.2	18.0	*	*	*
Sponge cake, 2 eggs, hot water	Piece, 3×2¾×⅛ in.	1½	42.5	150	11	2.7	10	1.1	129	32.2	4.6	1.6	2.5	2.9	*	*	*

* Compiled from various sources. Rose, Laboratory Manual. Rose, Feeding the Family. Sherman, Food Products, and others.

listed on the chart is shown in the three columns under the heading "Distribution of Calories and Grams." After adequate amounts of protein (10–15 per cent of the total energy requirement), mineral elements and vitamins have been provided, both well-being and economy demand that at least one-half of the remaining energy required should be obtained from carbohydrates.

3. The values given in the chart under *tissue-building factors* indicate the percentage of the total daily requirement of protein, calcium, phosphorus and iron for an average adult. The figures for the servings chosen for the day should total approximately 100 in each of these columns.[1]

4. The values given in the chart under *growth and health factors* on the relative distribution of the vitamin content of the foods listed are purely qualitative, and are not descriptive of any given quantity of the vitamin in the serving of the foodstuffs listed. Vitamins A, B and C should be represented in the food each day. In choosing food for vitamins the margin of safety is wider in the foods marked three plus (+++) than in the group marked two plus (++) or one plus (+) group; but if the foods have to be selected from the one plus (+) and the two plus (++) groups larger servings or a wider variety must be used.[2]

5. In order to claim and maintain growth and health it is necessary to have in the diet adequate amounts of food furnishing all the factors listed under *Growth and Health* in the food chart.

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[1] The standards commonly used and which are used in the chart for these food factors for the average adult male (70 kilograms or 154 lbs.) are: protein 67 grams (or in round numbers 70 grams equivalent to 2½ ounces); calcium 0.68 gram; phosphorus 1.32 grams; iron 0.015 gram. It is assumed that a woman consumes 0.8 as much food as a man.

[2] To interpret the vitamin table a single plus (+) indicates that the food contains the vitamin; two plus (++) indicates a good source of the vitamin; three plus (+++) indicates an excellent source of the vitamin; minus (–) indicates that the food contains no appreciable amount of the vitamin; a question mark (?) indicates doubt as to presence or relative amount; an asterisk (*) indicates that evidence is lacking or appears insufficient.

CHAPTER II

HISTORY OF CANNING

PROBLEMS OF PRESERVATION

The foundation of canning was made by Spallanzani in 1765. He showed that liquids which had been sealed in glass tubes and boiled in water for one hour remained unchanged as long as the tubes were sealed, but changed or spoiled when exposed to external air. These experiments disproved the theory of spontaneous generation which at that time was a subject for much discussion. Spallanzani concluded from his experiments that the " eggs " which caused foods to spoil were carried by the air.

Scheele, a noted chemist of his time, in 1782 made a practical application of Spallanzani's discovery by preserving vinegar in hermetically sealed bottles. Little or nothing more was done along this line for many years.

Nicholas Appert, " the Father of Canning," was born in 1750. He was a man of exceptional training for work in food preservation, for as he says: " having lived as it were in pantries, in breweries, in storerooms and in the cellars of Champagne, as well as in the factories of the confectioners and distillers, and in the storehouses of the grocers: accustomed to superintend and conduct establishments of this kind during forty-five years I have been (able to give a faithful account of my work) aided by numerous advantages which could not be procured by the majority of those occupied with the art of preserving foods."

In 1795 the French government offered a reward of 12,000 francs for a method of preserving food for army and navy stores. Appert, like many others, was stimulated by this offer of reward to engage in experimenting in methods of preserving foods. It was not until in April, 1804, that he discovered the secret, and after six more years of continued research he published his methods and received the reward offered by his government. He was successful in the preservation of practically all kinds of foods. So perfect was his technique that he was successful with some products which none other has ever been able to duplicate. His methods with only slight modifications are in common use at the present time, and are essentially as follows: The food to be preserved was

placed in glass bottles and loosely corked. The bottles were then set in a water bath and heated to 190° F. to 212° F. for varying periods depending upon the nature of the food. They were then removed and the corks forced in to give an air-tight seal. Appert's theory coincided in part at least with that of Spallanzani that there were certain elements in the air which caused food to ferment and decay and that by excluding

FIG. 2.—Nicholas Appert, 1750–1840.
"The Father of Canning."

the air the foods would remain pure and wholesome. Although Appert was in error regarding the causes of spoilage his methods of preserving foods were fundamentally correct.

In writing of his work to the French government he says: "This method is not an empty theory; it is the fruit of my meditations, of research, and of numerous experiments the results of which after more than ten years have produced such wonder that despite the evidence of having eaten of preserved foods for two or three years many persons still do not believe in it."

Gay-Lussac, the foremost chemist of his time, was asked by the French government to determine why foods treated according to Appert's method kept. His report, made months after, was to the effect that spoiling was a series of oxidation changes and that by excluding the air as Appert had done these changes were prevented. This explanation of why foods spoil held until the establishment of the germ theory.

The next important contribution to canning was made through the combined discoveries of Koch, Tyndal, Pasteur and Lister, whose work established the germ theory. This established the fact that all fermentation and putrefaction were caused by the growth of minute organisms known as yeasts, molds, and bacteria. These discoveries showed that these organisms are present on practically all foods and that their activities may be controlled by the application of heat.

Peter Durand, an Englishman, early in 1810 secured a patent covering the preservation of all perishable food in containers of glass, pottery, tin and other suitable metals. The method was practically the same as Appert's, from whom he had obtained his knowledge. This seems to be the first record of canning in tin.

The first canners in the United States were Ezra Daggett and Thomas Kensett, who packed some lobsters and oysters in New York in 1819. About the same time William Underwood arrived in Boston from England and shortly after began a general canning business. This business is still carried on under the firm's name of Underwood. It is the oldest canning firm in America and the second oldest in the world, that of Appert's near Paris being the oldest. In 1820 canning operations were begun in Baltimore, which soon developed into a canning center. During the next twenty years we read of various enterprises being carried on in New England, New York and the middle Atlantic states. Among those worthy of note was that of Isaac Winslow who, in 1839, began canning corn in Portland, Maine. All his early efforts were failures. Finally meeting with some success he applied for a patent in 1852 but so skeptical was the government that the patent was not granted until 1862 by which time he was reasonably successful.

It is a long step from Isaac Winslow and his twenty-three years of toil and disappointments trying to realize his ambition of safely canning sweet corn in tin cans to a modern corn cannery. Winslow could can a few hundred cans per day—the modern cannery is equipped with corn huskers each of which will husk three to four tons per day; corn cutters that will cut the kernels from 100 to 150 bushels per hour; fillers that will handle 125 cans per minute; can seamers capable of closing 60 to 90 cans per minute and processing vats sufficient to handle thousands of

cans per hour. And this step, gigantic as it is, has been made in a little more than a half century.

The period from 1840 to 1850 was one of development. Tomatoes were first packed commercially in New Jersey in 1847. Then came the discovery of gold in California and the rush of emigrants to that land of promise gave an impetus to canning, since canned foods offered the best solution of subsistence on the long journey whether made by sea or overland. During the next ten-year period many canneries for putting up fish and vegetables were developing along the Atlantic coast and the industry began to extend farther to the west.

The outbreak of the Civil War in 1861 stimulated the canning industry because of the urgent need for food to feed the armies in camp and field. The war did much also to popularize canned foods. The soldiers returning home at the close of the war did much to remove the prejudice which had heretofore prevailed. The soldiers had been eating canned foods, many of them for three or four years, and their knowledge and experience did much to allay the suspicions regarding the healthfulness of foods in tin cans.

Immediately following the war came a depression which extended over a period of ten years or more. During this time only the more experienced canners continued to operate. When business conditions began to improve the canning industry once more started to expand, and with much of the popular prejudice overcome the industry was launched on a period of prosperity.

The Tin Can.—The tin can, being light and non-breakable, very early became the container for commercial canning. The first tin cans had plumb joints which butted together and were held in place by a heavy coat of solder. The ends were soldered on. These cans were made by hand and it required a good workman to make his 100 cans per day. To distinguish them from glass containers they were called " canisters " in the early days, which some years later became shortened into cans. The stamped tin can appeared in 1847 and the pressed ends in 1849. The evolution of can-making machinery was slow. The double reaming machine appeared in the early seventies. The cans used on these machines required a paper gasket or rubber ring. They were not satisfactory since spoiled cans were about as plentiful as good cans. In the early nineties Charles M. Ames developed a liquid compound to be used in place of the paper gasket and through this discovery and through the invention of machinery for applying it to the covers and automatic machines for applying the covers to the cans the open top can came into great favor and bids fair to replace finally the older soldered-top can.

Methods of Cooking or Processing.—Appert used hot-water baths for all his work in canning. His temperatures varied from 190° F. to 212° F., depending upon the nature of the product. This same method of processing was followed by both English and American canners for many years. However, these early canners found this a great handicap because some of their foods such as sea foods and meats must be cooked for four to six hours. Naturally this long cooking period determined the output of the factory. In 1861 a Baltimore canner named Solomon by applying a discovery made by Sir Humphry Davy in 1808 reduced this long cooking period to an hour or less. By dissolving the proper amount of calcium chloride in the water bath the temperature of the boiling water was raised from 212° F. to 240° F. thereby reducing the cooking period so much that the capacity of the cannery was increased many times.

In 1874 A. K. Shriver, another Baltimore canner, invented and patented a closed kettle for cooking with either superheated water or steam. The introduction of Shriver's method, as it was called, brought about a revolution in canning methods. With a number of these processing kettles the canner's problem was no longer that of cooking but of supplying a sufficient number of cans to keep his processers going.

Beginning with the advent of the steam retort for processing canned foods, American inventive genius has labored to place at the canners' disposal labor-saving machinery. So successful have they been that nowhere will one find such well-equipped food factories as ours. The ideal of the canner is to take the raw material in enormous quantities as it comes from the field, prepare the material, and place the prepared product in the container, seal it and process it without having had it touched by human hands. He has realized this ideal with some products, notably sweet corn, string beans, peas, and some others.

The first application of bacteriology to canning was made by Russell of Wisconsin in 1895. The pea canners of that state had been having serious losses, and Russell, after a study of the problem, finally isolated the bacterium which was the source of the trouble. Upon his recommendation the processing period was lengthened and losses in canned peas were greatly reduced. The following year Prescott and Underwood of Massachusetts Institute of Technology began a series of studies of the bacteria affecting canned goods, principally those affecting corn. Prior to this time the canner had been working on the old method of "cut and fit."

During the past twenty-five or thirty years there has been a great change in methods of processing, and particularly along all lines of factory sanitation. The scientist has given his best to the canner and the

canner has cooperated to such extent that most of our canneries have become models in sanitation and efficiency. Many of the larger ones now maintain their own force of chemists and bacteriologists.

The passage of the federal pure foods law in 1906 has had a profound influence on the canning industry. It has protected both the consumer and the honest canner and it has done much to put the dishonest packer out of business or has brought about his reformation. The confidence of the public in the safety of canned foods has steadily increased until at the present time the canners enjoy the full confidence of the great army of consumers.

THE DEVELOPMENT OF HOME CANNING

The methods developed by Appert did not come into general use in the home for about a century after his discoveries were published. Such home canning as was done during the greater part of the nineteenth century was confined mainly to fruits and tomatoes. Strange as it may seem, home canning during this period was not done according to the methods of Appert but by what later came to be known as the open kettle method (see page 23). Occasional home canners are known to have canned a few of the non-acid vegetables by the open kettle method, but they used salicylic acid or some one of the " canning " powders prevalent at that time. An occasional record may be found of some thrifty homemaker who canned both fruits and vegetables by Appert's method, now known as the can-cooked method of canning (see page 24).

Quite late in the nineteenth century and early in the present one fragmentary literature describing methods of home canning began to appear from widely separated sections of this country.

In 1905 the Louisiana Experiment station published a bulletin recommending the canning of fruits and vegetables, except corn and peas, by the can-cooked method. The following year the Oregon Experiment Station published the results of two years' research in canning methods. This bulletin recommends the intermittent method of processing for all fruits and vegetables. In the annual report of the Missouri State Board of Horticulture for 1908 is a lengthy article describing methods used in farm canning throughout the South. The methods of cooking or processing given are now known as the single period or continuous processing. Except for corn, the processing periods given for vegetables are about one-third those recommended at the present time.

In 1909 the United States Bureau of Chemistry published Farmers' Bulletin 359, which is a discussion of vegetable canning. The intermittent method of processing is recommended.

In 1913 Farmers' Bulletin 521 was issued. This marked the entry of the Boys and Girls Club activities into the field of home canning. During the next few years the States Relations Service issued a number of canning circulars and bulletins. This literature was for use in the Boys and Girls' Club work. The literature circulated through the Southern states advocated the intermittent method of processing for all non-acid foods whereas that intended for the more northern states recommended the one-period method of processing.

It was in this manner—after a lapse of more than a century—that Appert's methods of canning, adapted to modern conditions, became available to the homemaker. These " new " methods of home canning were just coming into general use when the world war came on. The need for food caused a tremendous growth in home canning and this household art quickly emerged from obscurity to occupy a prominent place in the economy of thousands of homes. It was only natural that during this period of growth there should be some development. There have come many changes in methods of procedure since the advent of our pioneer literature and each succeeding year is marked by changes which make for greater safety in our methods of home canning.

As the Extension Service has developed and as the literature has become more reliable because of larger experience, canning in the home grew to be an important factor in many communities. Canning is of such importance that it is now a part of the curriculum in Home Economic courses in many high schools and colleges. No extension program is complete that does not include some work in both adult and junior club canning. Another development has come through the growth of the small home or farm canning and manufacturing plant. This phase of home canning has a promising outlook especially in those sections whose population is largely urban.

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CHAPTER III

CANNING

A GENERAL DISCUSSION

Canning is one of the most widely used means of preserving the perishable fruits and vegetables. Until within comparatively recent years canning in the home or in a small way was restricted to fruits and tomatoes. If non-acid vegetables were canned a preservative consisting of some harmless acid was added to the vegetable, to insure its preservation. During the past quarter century, however, canning in the home has been steadily increasing due to the adoption of methods which today enable the small operator or the home canner to preserve successfully all kinds of fruits, vegetables, meats, poultry, and sea foods. The thousands of packages of these various foods canned in the homes throughout the country attest to the reliability of present-day methods.

There are many reasons why canning should be a profitable enterprise in the home or small farm factory. Some of the foremost of these reasons are:

1. Food materials are saved that would otherwise be lost.
2. Canning provides the home with a large supply of foods which allow greater variety in the diet, thereby giving better-nourished bodies.
3. An immense amount of labor is saved in the preparation of meals if an adequate supply of canned foods is available.
4. Canning the surplus, or the purchase of raw materials when they are cheap and canning them, will result in considerable saving in the item of table expense.
5. Canning, operated as a business, offers almost unlimited opportunities for growth and development. (See Chapter XXII, The Home Factory.)

The most successful canner is the one who knows or seeks to know the "why" of every operation in the business. To know "how" is to be merely an artisan, but to know both "how" and "why" is to be an artist and a scientist.

Canning Defined.—Canning has been defined as the preservation of foods in hermetically sealed containers, the preservation being accomplished by the means of heat.

Functions of Heat.—Heat as applied to the canning of food performs three distinct functions:

(1) It cooks the raw materials making them more nutritious and palatable.

(2) It destroys or renders inactive all organisms and enzymes in contact with the food.

(3) As a general rule the heat is relied upon to develop some degree of vacuum within the container, making possible a reliable hermetic seal.

METHODS OF CANNING

The method of applying the heat and the time during the canning operation at which it is applied give us two distinct methods of canning: (1) open kettle canning, (2) can-cooked canning.

Open Kettle Canning

When foods are canned by the open kettle method the procedure is essentially as follows: The prepared materials are placed in a suitable sized cooking vessel and sufficient liquid, water, fruit juice or sugar syrup is added to prevent scorching and to facilitate cooking. The kettle is then set on the fire and brought to the boiling point. When the materials are thoroughly heated, that is, when they boil steadily while being gently stirred, they are quickly transferred to containers which together with their covers have just previously been boiled for several minutes and which are still hot. The containers are filled and the covers are applied at once, thereby sealing the hot foods air-tight. The containers are then set aside to cool before storing.

The shrinkage of foods during cooling develops the necessary vacuum to maintain the seal and to prevent further enzyme action. This method of canning is restricted to acid foods, that is, all the fruits and such vegetables as tomatoes and rhubarb, although foods such as pickles, relishes, etc., to which have been added a liberal amount of vinegar may also be canned in this way.

There are some decided objections to this method and it is therefore rapidly falling into disuse. Soft fruits like the berries are very likely to break up, giving a rather unattractive appearance. Aromatic fruit loses much of its flavor and consequently its quality is lowered. Firm fibrous fruits like the pear and peach, if not over-ripe, may be canned very successfully, and tomatoes and rhubarb are canned equally as well by this method as by any other. But because it is so restricted in its application and because many fruits are injured in appearance or

quality or both, the method is not to be recommended for the general canning of fruits. This method is frequently resorted to when canning manufactured fruit products such as butters, conserves, jams, and marmalades. However, as a rule the can-cooked method is more satisfactory with these products.

Can-Cooked Canning

In the can-cooked method the materials, properly prepared, are packed into the containers in a raw, partially cooked or wholly cooked condition after which they are subjected to a heating or processing period in the sealed or partially sealed containers. This is the method practiced by Appert, the discoverer of canning, and is the method in general use throughout all commercial canning factories. It is also the method that is superseding the open kettle method of canning in the home. Foods canned by this method retain their shape better, there is less loss of aroma, the quality is of the best and all foods may be canned with perfect safety.

Methods of Applying the Heat.—There are four general methods of applying the heat to the foods after they have been packed into the containers: (*a*) the one period method, (*b*) the intermittent or fractional method, (*c*) the steam pressure method, (*c*) the pasteurization method.

(*a*) *The One-Period Method.*—By this method the sealed or partially sealed packages of food are subjected to a single period of heating in either steam or hot water at a temperature of boiling water. The length of the period is determined by the nature of the food, the solidity of the pack and the size of the container.

This is the method used most generally throughout the Northern and Eastern states and is the one most commonly recommended for home and small factory canning, in that section, provided the elevation is less than 1000 feet above sea level (see chapter on Thermometers and Temperatures).

Its chief advantage lies in its simplicity and in its economy of time, energy, and fuel; and where strict regard is had for every detail in the preparation of materials and in filling the containers general satisfaction is the result. Scientists, however, are not yet ready to advise using this method for canning meats and such vegetables as corn and peas. Their objections are based upon the fact that there is a possibility of these products containing organisms which can withstand boiling temperatures for a longer period than are used for processing these products. Should the organisms be present the foods are likely to spoil. There is unques-

tionably less risk if such foods can be processed by steam pressure. However, just as long as canners continue to be successful with the one-period processing just so long will it be the method employed by the small canner.

(b) *The Fractional or Intermittent Method.*—This is the method that is in more general use for non-acid foods throughout the South where climatic conditions present more difficult problems to the canner than are found in colder sections. The method is applied only to meats and the more difficult vegetables and is essentially as follows: The prepared foods are packed into the containers as in the one period processing and are then subjected to a relatively short processing at temperature of boiling water on each of three succeeding days. The length of each processing may vary somewhat with different materials, ranging from sixty to ninety minutes.

This method is based upon sound scientific principles. It is taken from what was formerly the common laboratory method of sterilization. By subjecting his cultures or media to this method of processing if proper precautions were taken between cooking periods the laboratory worker could be sure that his materials were sterile, that is, all micro-organisms had been destroyed. This method is based upon the well-recognized principles that (1) active or vegetative bacteria are destroyed by a few minutes of boiling temperature and (2) spore forms of bacteria develop rapidly into active forms under the influence of heat. Hence the method works as follows: The first processing period if sufficiently prolonged will destroy all active forms of bacteria. During the interval between the first and second processing all or practically all the spores will develop into active forms. These will be destroyed during the second processing. Another processing is given the day following in order to destroy any late developing spores which were not active forms at the time of the second processing. This method, if properly applied, will practically insure sterile packages.

The most serious objection to the general use of this method of processing is that it is too expensive in time, energy, and fuel, besides being of considerable trouble where much canning is being done. In fact as the amount of canning increases, the difficulties in applying this method become so great as to render it practically impossible.

In those sections of the country where the one-period processing has proven satisfactory there is no occasion to use the intermittent method unless one has had trouble in keeping vegetables or meats when the one period processing was used. Under such conditions one should resort to this method if the steam pressure cooker is not available. In those sections where the one-period processing is known to be unsafe the steam-

pressure method is recommended as more economical than the intermittent method and equally safe.

Jars which are self-sealing by means of a soft composition are not suitable for use if this method of processing is used.

(c) *The Steam-Pressure Method.*—This is the method which is used almost altogether in commercial canning of most vegetables, meats, and sea foods and it is also rapidly being introduced into the home and farm factories.

The prepared foods are packed into the containers as described in the above two methods, the containers are then placed in a steam retort where through pressure the processing temperature can be raised far above that of boiling water. There are no known bacteria that can endure a temperature of 240° to 250° F. for very many minutes. This method of processing has two very strong arguments in its favor: (*a*) Processing is less expensive in time, energy, and fuel; (*b*) meats and vegetables processed in this way will show a minimum amount of spoilage. The only objection is the initial expense of the necessary equipment. This objection is rapidly being overcome by the newer types of equipment on the market and by other uses than canning which may be made of steam-pressure canners.

(*d*) *Pasteurization.*—When foods are heated in containers or under other methods to a temperature below the boiling point of water for a definite period the process is called pasteurization. There are two general types of pasteurization; (*a*) temporary, such as is given to market milk, the purpose being either to destroy some pathogenic organism or to control temporarily any spoilage organisms; and (*b*) permanent, in which the food material is subjected to a low temperature for the necessary length of time to insure keeping. The containers are then hermetically sealed and the food will keep indefinitely. This method is used to preserve fruit juices such as grape juice and sweet cider and experiments have shown that it might safely be used in preserving all soft fruits. The food materials to be preserved are filled into containers, which are then placed in a steam vat or water bath. The desired temperature (156° to 170° F.) is then obtained and held for the proper time determined by the character of the material and the size of the package.

The advantage in using this method for the preservation of fruit juices and certain soft fruits lies in the fact that they will have less cooked flavor than when processed at higher temperatures.

PROCESSING

The processing is the most important operation in canning. No matter how carefully all other steps have been performed, if the processing is not thorough trouble is sure to result. If the only object were to secure a package of food that would keep it would be a relatively very simple matter to prolong the period until even the most resistant bacteria have been brought under control. But unnecessary heating will injure the texture and quality of the products. It is therefore rather a high art to be able to process food sufficiently long to insure its keeping and at the same time to secure the maximum quality. It should be kept constantly in mind, especially by the beginner, that the processing is for the purpose of preservation rather than simply to cook the food for immediate consumption. Certain foods like sweet corn require only a few minutes' cooking at boiling temperature to render them suitable for consumption, yet when canned these same foods would require several hours' boiling.

Factors which Determine Length of Processing.—Certain things must be taken into consideration when we attempt to fix the length of the processing period for the various foods. Therefore a brief discussion of the most important factors influencing the processing period ought to be of interest at this point.

1. *The Character of the Product.*—This factor divides the food materials into two great groups: (*a*) acid foods and (*b*) non-acid foods.

(*a*) *Acid foods* are most easily preserved. The presence of acid renders the material an unfit or uncongenial medium for the growth of bacteria. As already noted, molds and yeast are comparatively easily destroyed. Consequently a few minutes at the boiling temperature of water is sufficient to preserve all the fruits and tomatoes. (See also pasteurization, page 26.) Such foods then require a relatively short processing.

(*b*) *Non-acid foods* are congenial media for practically all spoilage bacteria, hence their preservation is possible only by prolonging the processing period far beyond that of acid foods. Non-acid foods therefore require relatively long processing to insure keeping.

2. *The Degree of Ripeness or Maturity.*—Hard or unripe fruits should be processed longer than ripe fruit. This not only involves preservation but palatability of the product also. With vegetables on the contrary, the more nearly mature the vegetable as a rule the longer it should be processed. Large, fairly matured peas will not conduct heat as readily as do young and tender peas. Consequently a processing period that would preserve a package of matured peas would over-cook

the young tender peas. This same general rule will apply equally well to sweet corn and shell beans.

3. *The Size of the Package.*—The size of the package influences the processing period this way: The larger the diameter of the package the longer the time required for the heat to penetrate throughout and to raise the center of the package to the required maximum temperature. As a general rule the height of the package is not considered, that is, if one were using pint and quart jars of the same diameter in canning a given food, they should be given the same processing period. If, however, the tall, narrow pints were used the processing period for them could be shortened somewhat.

Dr. Bitting has worked out a general rule for the rate of heat penetration. This is not an absolute rule because of so many influencing factors, but is of considerable interest to the small canner since it will enable him better to estimate the processing periods of food materials if containers of different sizes are used. The general rule is stated as follows: The time necessary for heat to penetrate to the center of containers is approximately proportional to the squares of the radii of the containers. This applies only to containers uniformly packed with the same kind of food materials. Knowing the processing time of one size container, that of the others may be readily computed by applying the above formula.

4. *The Consistency of the Material in the Container.*—The penetration of heat from the outside to the center of a package of food during processing is governed by the fairly familiar laws of conduction and convection. Conduction is the transfer of heat between two adjacent particles; that is, one becomes heated and passes the heat on to the next adjacent one. We know that materials differ in the readiness with which they absorb the heat and pass it along to the adjoining particle; hence some substances are called good conductors, others are poor conductors, and still others are practically non-conductors. Convection is a transfer of heat by means of movements or currents within a volume of liquid or gas. It is brought about by the expansion of the heated portion which, making it lighter, causes it to rise and mix with the colder portions above. Transfer of heat downward or laterally is by conduction rather than by convection.

The application of what has been said concerning heat penetration to the business of canning is as follows: Heat penetration in containers filled with solid or nearly solid materials must be relatively very slow since the heat is carried in by conduction. On the other hand, if the contents of containers are liquid or if the particles of food are well surrounded by a liquid free to move, heat penetration is relatively very

rapid, since the heat is transferred by convection. It must be evident therefore that the rate at which heat penetrates the container is largely governed by the ease with which convection currents may be formed. Foods that tend to pack tightly together, as greens and sweet corn, are frequently over-packed, causing serious losses of canned foods. The canner should therefore adopt some practice whereby the amount of solid contents is fairly uniform, of sufficient amount to insure a full, attractive pack yet not so tightly packed as to require extra long processing in order to insure preservation.

5. *Temperature of the Processer.*—The final determining factor is the temperature within the processer. Under normal conditions of atmospheric pressure at or near sea level the boiling point of water is 212° F. A food which would normally be processed at boiling temperature, or 212° F., for two hours would be preserved if processed for 35 minutes under 10 pounds steam pressure at a temperature of 240° F.

The temperature of boiling water falls approximately 1° F. for each 500 to 600 of elevation above sea level. It must follow then that processing in the water bath becomes more difficult as the elevation above sea level increases. Fruits may be safely processed at elevation of 1000 feet or more by lengthening the processing period. It is extremely doubtful if vegetables, meats, and poultry should ever be processed in the water bath at elevations exceeding 1000 feet. Under these conditions the canner should make use of the steam pressure processer for all foods except fruits and tomatoes.

6. *Initial Temperature of Processer.*—This applies primarily only to fruits. The temperature of the water bath should be 150° to 180° F. at the time the packed containers are placed in it. The length of the processing period for most fruits bears a close relation to the initial temperature of the water bath.

SOME PROBLEMS IN CANNING

Both the canner and teacher are called upon to explain why a great many things are as they are in canned foods. A few notes on some of the more common problems may restore the confidence of the canner and also help the less experienced teacher over some difficult places.

I. Why Fruits Float in the Jar.—This is a very common occurrence and is explained as follows: (*a*) *Character of the fruit.* Some fruits are soft, tender or juicy. When heated their internal structure breaks down, the fruit collapses and as a result tends to float toward the top of the jar. Examples are, strawberries, soft juicy plums. (*b*) *Improper packing.* If jars are not properly packed, that is, if not enough fruit is

packed into the jar, the tendency always is for loosely packed fruit to float in the syrup. This is a natural result since the specific gravity of fruit is less even than water. (*c*) *Over-processing.* Fruits that are much over-processed become soft and float for the same reasons as given under (*a*). (*d*) *Syrup too heavy.* If the syrup is too heavy it will cause a shriveling of the fruit and a consequent floating. Canning syrups should be adapted to the acidity of the fruit, and rarely will one require heavier than 50 or 60 per cent sugar (see page 66).

II. Lack of Liquid in the Jars.—This is one of the most common troubles when canning in glass jars. Furthermore it occurs in canning almost all foods where a free liquid is a part of the jar's content.

Some of the most common causes are:

1. *Improper Packing.*—If the materials are packed too lightly in the neck of the jar the gases and steam do not escape readily, consequently pressure is set up within the jar. When the pressure becomes sufficiently great to force an opening through the tightly packed neck a portion of the liquid content is carried out with the escaping gases and steam.

2. *Air Pockets Left in the Jar.*—When the liquid is poured in over the solids, large pockets of air are likely to be imprisoned among the pieces of solids. These escape during processing and the liquor level sinks because these spaces are now filled with the liquid. This difficulty may be overcome by: (*a*) using hot liquids. The heat expands the air and it bubbles out. After standing a few minutes, more liquid is added to give proper fill. (*b*) Agitation of the jar after pouring in the liquid will generally cause the air to become dislodged. The jar may be grasped around the neck and rotated quickly to right and back again for a few times, or (*c*) a thin flexible spatula may be run down the side of the jar and by pressing outward on the handle the blade will press inward upsetting the equilibrium of any air bubbles.

3. *Insufficient Blanching.*—In some cases, for example, string beans, asparagus, sliced apples, etc., blanching is primarily given for the purpose of expelling included gases. If this is not done the gases are expelled during processing. Then after removal of jars from the processer much of the liquid is absorbed by the solids leaving the free liquor at a low level in the jar. In blanching and cooling such products the operator should endeavor to leave materials in the blanching water as long as safety will permit and in cooling they should be left in the cold water long enough to insure absorption of water to fill spaces formerly occupied by the gases. Well blanched and properly cooled materials of this character will sink in cold water rather than float in it.

4. *Jar Too Tightly Sealed.*—In all common types of jars used in home

canning, provision is made for the jar to be only partially sealed during processing. The method of providing for this is discussed in Chapter V, Containers and Their Manipulation. Pressure is necessary to lift the cover sufficiently to allow for escape of gases; but if considerable pressure is necessary to lift the cover the pressure is uniformly distributed throughout the jar and when it becomes sufficiently great to lift the cover the outrushing gases carry some of the liquids with them. The same principle applies here as in the bottle of soda water. When the cover is suddenly removed both gas and liquid flow out of the bottle.

5. *Improper Manipulation of the Processer.*—When processing in the water bath it is very desirable that the tops of the jars shall be covered with water throughout the processing period; or, failing in this, the processer should be equipped with a cover which should be taken off just before the fire is removed from under the processer.

When processing under steam pressure the pressure should be maintained fairly uniform throughout the processing period. The pet cock must not be opened until the pressure inside the processer has fallen to zero.

When processing is taking place in the steamer the doors of the steamer must be opened before the fire is removed. Otherwise a vacuum may form within the steamer causing the liquid to flow out from the jars. This same condition is likely to obtain in the case of the covered water bath if the water does not cover the tops of the jars. Because under these conditions the water bath actually becomes a steamer and should be manipulated as such.

III. Spoiling of Canned Foods.—As a general rule the spoiling of canned foods may be attributed to one of the following causes:

1. **Imperfect Containers.**—There are many ways in which a container may be imperfect. But if because of cracks, bubble holes, imperfectly fitting covers, the jar does not seal air-tight after processing, the food is sure to spoil. Careful inspection of jars before packing will eliminate a large amount of this trouble.

2. *Poor Sealing Medium.*—If the rubber ring or other sealing medium is not in good condition the jars will not seal and spoilage is sure. Rubber rings should be thoroughly tested and if a composition material is used instead of a rubber it should be examined carefully. It should be fairly soft and should be continuous around the edge of the cover. If hard and brittle or if there are broken places, these covers should be discarded. *Jars must be sealed air-tight if food is to keep.*

3. *Over-Packed Jars.*—All processing periods are based on moderately packed containers. If those materials which tend to form a tight pack with little or no free liquid present are over-packed a normal

processing period is insufficient to preserve them. The canner would better err on the side of under-packing and have palatable foods rather than to over-pack and have spoiled foods.

4. *Under-Processing.*—There are so many ways in which the home canner may under-process and still feel sure that the proper time has been given, for example, begin counting time too soon, temperature below proper degree for a part of the period, water allowed to boil off exposing tops of jars, slightly over-packing, water boiling below 212° F., etc. Too much emphasis cannot be placed upon care in processing. The canner would far better extend the period of vegetables, meats and poultry beyond the normal period than to make any reduction.

5. *Improper Manipulation of Materials.*—Much of the flat sour troubles no doubt arise from allowing blanched materials to stand around too long before processing. The bacteria which are responsible for this trouble thrive best at temperatures of 100 to 150° F. (see chart, page 3). Prepared materials then should be kept cool until they can be processed. If prepared materials are packed and covered with hot liquid, they should go into the processer within the hour. Green vegetables should not be packed into bags or baskets and allowed to heat before canning. This is one prolific source of poor quality canned vegetables.

6. *Storage.*—Canned foods should be stored in a cool place. Warm storage hastens deterioration and spoilage.

IV. Discoloring of Fruit.—Sometimes the fruit in the top of the jar turns brown or black after the jar has stood for some time. This is due to enzyme activity and indicates under-processing. Either the processing period was not long enough to exhaust the air properly or the temperature of the fruit was not sufficiently high to render the enzymes inactive. This trouble is most likely to occur with large fruits such as pears, plums, and peaches. The remedy is an increase of a few minutes —5 to 10—in the processing period.

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CHAPTER IV

CANNING EQUIPMENT AND ITS MANIPULATION

The equipment necessary to do good work in home canning need not be expensive. Much of it will be found in the well-equipped kitchen. Canning equipment may be listed under the following heads:

(*a*) Measuring.
(*b*) Preparation and handling materials.
(*c*) Closing devices.
(*d*) Handling containers.
(*e*) Processers.
(*f*) Miscellaneous.

EQUIPMENT FOR MEASURING

The canner should not under-estimate the value of careful measurements. Success or failure is usually determined by the care with which

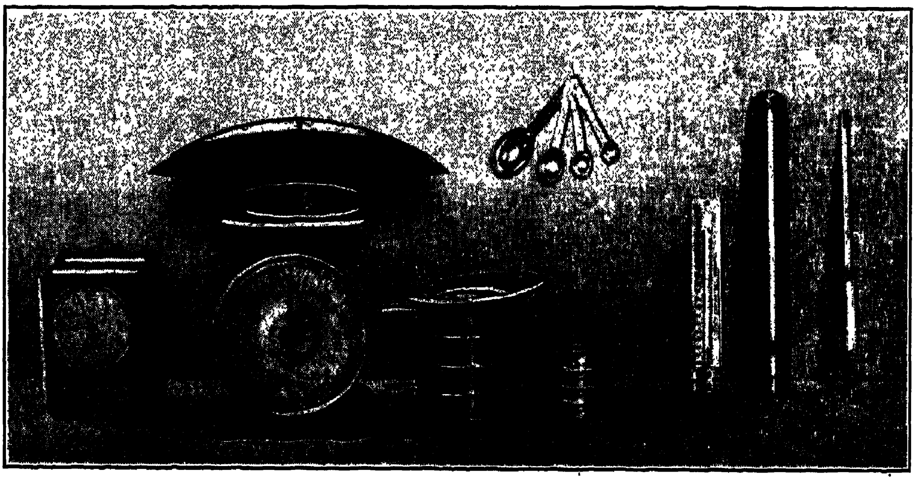

Fig. 3.—Equipment for measuring.

materials, temperatures and time are measured. The principal equipment under this head consists of: measuring spoons for small amounts, a graduated measuring cup, also quart measure for liquids and for some solids, scales for weighing raw materials and for determining contents of packed containers. A thermometer for measuring temperatures is not necessary except for use in the steam processer and in pasteurizing but the canner will find many useful purposes for it if one is available.

Hydrometers with hydrometer jar for determining the density of syrups and brines will aid in securing uniform packs. A clock or watch is absolutely indispensable for timing blanching and processing operations.

PREPARING AND HANDLING MATERIALS

Since materials differ in manner of preparation different types of equipment are necessary to prepare them easily and efficiently for packing.

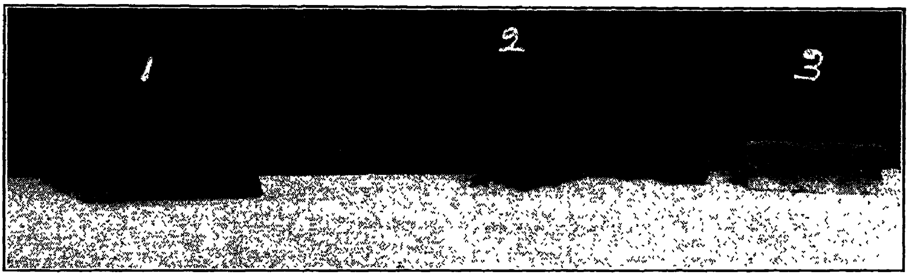

FIG. 4.—Types of brushes.

1, for washing jar; 2, scrub brush for washing utensils and vegetables; 3, vegetable brush, also useful for removing silks from ears of sweet corn.

Practically all raw materials must be washed. There should be provisions for washing, including an adequate water supply. Brushes are

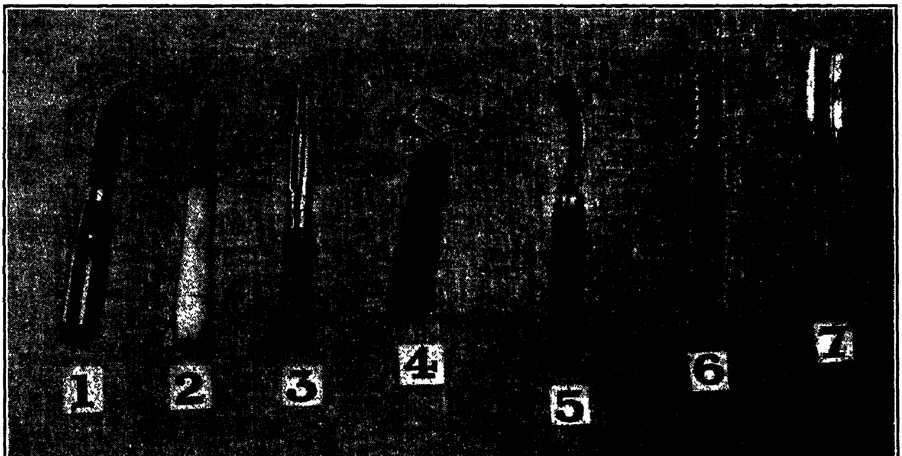

FIG. 5.—Types of knives.

1 and 2, paring knives; 3, apple parer and corer; 4, pear corer; 5, pear peeler; 6, corn creamer; 7, corn slicer.

useful for cleansing all root crops and removing silks from sweet corn. Colanders or sieves are excellent for rinsing peas, shell beans, cut beans,

etc., and for draining blanched materials. Knives, preferably of the stainless steel which can be made sharp, are required in preparing many materials. A stone should be available to keep the knives sharp. Blanching equipment is required. It may consist of a vessel of reasonably large size, ten quarts or more, in which to heat the water, also wire baskets or squares of cheesecloth to hold the raw materials. Special equipment such as peeling machines, peeling and coring knives, and slicing machines will facilitate the work and save much time. In addition there must be pans, kettles, or other containers for holding both the materials and the waste.

CLOSING DEVICES

If the commonly available glass jars are used no special device is necessary since those commonly used in the home are "self-sealing." However, if one is canning in tin cans special closing equipment is necessary. The canner may exercise a choice of either of two distinct types of tin cans. These are known by their trade names as open top or sanitary cans and the cap and hole cans. The former is strongly recommended on the grounds of economy of time saved and ease of operation. It will cost more to buy equipment for closing the open-top cans but the time saved and the greater security one may have in using this type of can will more than offset the difference in cost.

The small hand double seamers now available for closing the open-top can are very efficient if kept properly adjusted. They are easily operated and may be had in the standard sizes. Instructions for operating accompany the machines.

The equipment for closing the cap and hole can consists of a capping steel, a tipping copper and a source of heat. Accessories are a flat file, soldering flux, solder, and sal ammoniac, the last for keeping the tools clean and in good working condition. (The manipulation of this equipment is described in Chapter V on Containers and Their Manipulation.)

EQUIPMENT FOR HANDLING CONTAINERS

The handling of filled containers becomes quite a problem where a considerable number of packages are handled at one time. Some means must be at hand to assist in placing these in the processer and in removing them at the close of the processing period. The simplest device is wire carriers holding half a dozen or more jars and made of proper size to fit into the processer. The carriers may be used to transport the containers from the packing table to the processer, for placing jars in the canner, and for their removal at close of processing. For handling single packages there are the can tongs for tin cans and various types of

jar lifters which may be had from the large department stores. The essentials of a good jar lifter are that it is easy to operate and that it takes a firm hold upon the package. Hooks that fasten into the bale

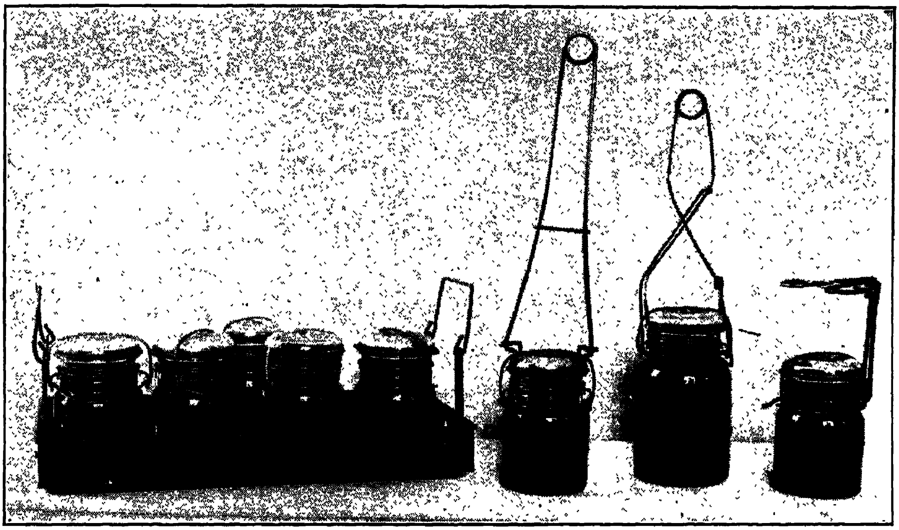

FIG. 6.—Equipment for handling jars into and out of the processor.
At the left, a tray which carries 6 to 10 jars. At the right, types of jar lifters.

of the lightning type jars are not as desirable as those that grasp the jar around the neck. Lifting the jar out of the processer by the bale is very likely to allow escape of both steam and liquid, due to lowering the tension the bale exerts on the cover.

PROCESSING EQUIPMENT

There are two general types of equipment for processing, determined by the maximum temperature which may be developed in them: (1) Those that develop a maximum temperature of boiling water—this type is represented by the water bath and the steamer; (2) those that develop a maximum temperature above that of boiling water—this type is represented by the water seal processer and the steam pressure cooker or retort.

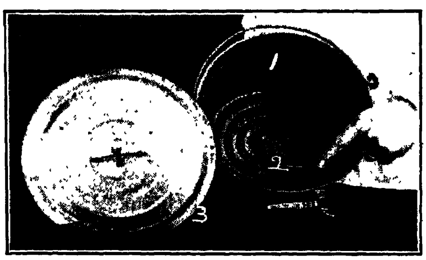

FIG. 7.—The essential parts of the water bath processer.
1, the vessel; 2, the rack; 3, the cover.

The Water Bath.—This is the simplest and cheapest type of equip-

ment. It consists essentially of three parts: (*a*) the vessel, (*b*) the rack, (*c*) the cover.

The depth of the vessel should exceed the height of the jars by three or four inches. Its length and width will be governed somewhat by the volume of canning to be done and by the source of heat. If the processer is to be placed on a range or over gas or kerosene-oil stoves, it should not be so large as to project much beyond the heating surface.

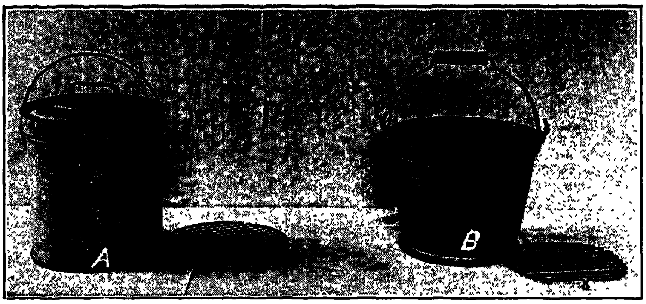

FIG. 8.—Types of water bath processers.
A, waste can; *B*, galvanized iron water pail.

For home canning the following vessels will be found quite suitable: Galvanized water pails of 14- to 16-quart size, or clean, new garbage pails; lard cans or the family wash boiler—or a vessel can be had from a local tinsmith made to size suitable to the heating surface to be used. Any metal container deep enough to allow for false bottom and two to three inches of water over the tops of the jars will be satisfactory. A cover of some sort is very desirable. It prevents unnecessary loss of water through evaporation and guards against exhausting liquid contents of glass jars should the water fail to cover the tops during the whole period of processing. Furthermore a good cover will economize on fuel. The water may be more quickly heated to boiling and less heat is required to maintain the maximum temperature during processing. In addition there is less loss of water through evaporation. Covers are of three general types as shown in illustration, page 39. Type A is simply a flat piece of metal which rests upon the top of the processing vessel. An ordinary pot lid or cover is a common illustration of this kind of cover, which will serve all ordinary purposes. The objections to this cover are: (1) Excess loss of water through escaping steam and (2) the dripping of water from the outer edge of the cover due to the condensation of escaping steam. Type B as shown has a flange which fits outside the processing vessel. This kind is illustrated by the garbage pail cover. The objections to this cover are practically the same as with type A.

except there is a greater condensation of escaping steam due to its interception by the flange. Type C differs from B in that the flange fits within the processing vessel. This type is best represented by the wash boiler cover. Type C represents the most efficient cover.

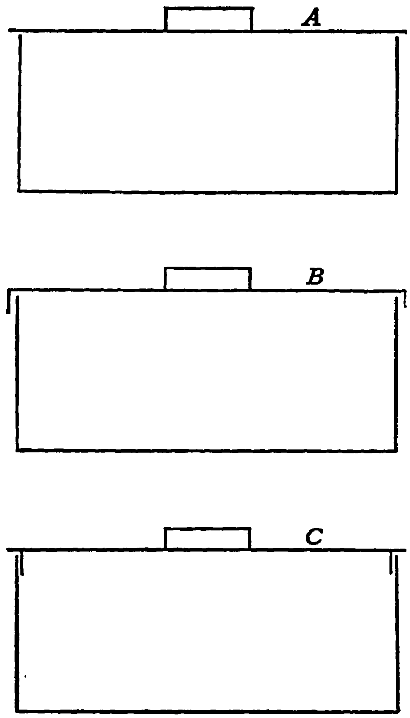

FIG. 9.—Types of covers used on water bath processers.

The rack or false bottom is a very essential part of the equipment. Its function is to lift the jars above the bottom of the vessel in order to prevent their rocking or breaking. It may be a sheet of cellar window wire cut to fit the vessel, or, if a small round vessel is used, cake coolers make good racks. Wooden racks are often used in wash boilers and other rectangular vessels, but they are objectionable unless handles are attached so that the whole number of glass jars can be lifted out at one time. If jars must be removed one at a time with a holder, the last one or two will not be heavy enough to keep the rack from floating and as a result the jars may be overturned. A sheet of woven wire is preferable to a wooden rack.

There are many types of commercial hot-water processers on the

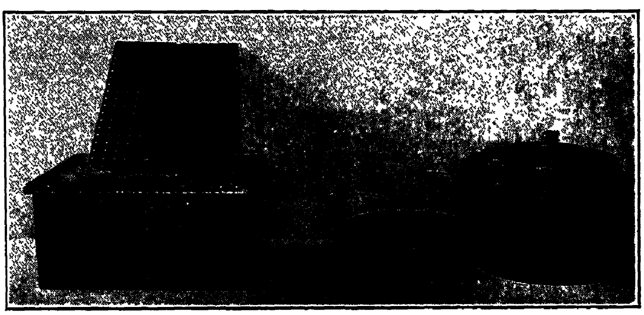

FIG. 10.—Types of water bath processers which may be purchased for use in home canning.

market. Many of these have little or nothing to recommend them over the types suggested above. Generally they have a number of

accessories such as trays, scalding baskets, can tongs, etc. Some have specially contrived heating surface designed to reduce fuel expense. Many have their own fire-box which enables one to set up the canner in a convenient shed or out-building. In purchasing a processing equipment, better value for initial cost will be had if the vessel is made of good galvanized iron rather than tin plate.

The operation of the water bath is very simple. The utensil is filled with water to a depth such that, when the containers are in place, the water will be over the tops of them to the depth of at least one inch, if processing is short, or two or three inches if the period is to be a long one. The water in the processer should be as hot as can be borne by the hand before containers are placed in it. When the containers are all in, the cover is placed in position and the heat applied as rapidly as possible until the water is boiling. The heat should then be lessened until there is a moderately vigorous boiling throughout the processer. If the vessel is long enough to extend over two gas or oil burners both flames should be lowered rather than to turn one out depending upon only one burner to maintain the proper processing temperature. It should be kept in mind that convection currents tend to travel in vertical rather than in horizontal directions. If the fire of one burner is turned off and boiling is maintained by the other burner a thermometer may show a difference of 2° F. in the temperature of the water at the two ends of the processer.

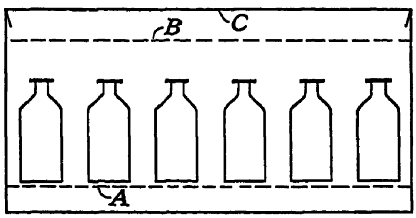

FIG. 11.—The water bath processer in operation.

A, the rack upon which the jars stand; *B*, the water line; *C*, the cover.

Should the water level fall below the tops of the jars during the processing period the cover should not be removed until the close of the period.

The Steamer.—There are several types of steamers but they all conform to the general principle of construction of having a reservoir for holding water at the base. Above this is the steam chamber. During operation the water in the base is heated to the boiling point and the cooking chamber above becomes filled with steam at the temperature of boiling water. The heat therefore is applied to any materials in the cooking chamber through the medium of steam under atmospheric pressure.

There are many advantages in using a steamer as a processer. The steamer is economical of both time and fuel. It is easily handled and simple to operate. The beginner, at least, should not operate a steamer

as a processer unless it is equipped with a thermometer for indicating the temperature within the steam chamber. It is extremely doubtful that one can afford to rely upon his judgment as to the probable temperature within the steam chamber.

The operation of the steamer is as follows: The water chamber is filled with water almost up to the rack if the processing period is to be a long one. If short processing is to be done less water need be used. The steamer is set over the fire and when the water is near the boiling point the containers are set in the steam chamber. The cover is adjusted or the door is closed, as the case demands, and heat is applied as rapidly as possible. When the thermometer, previously attached through the cover with its mercury bulb near the top of the containers, records the temperature of boiling water the time of the processing period begins. The fire may now be lowered somewhat in the interest of economy, care being taken that, throughout the processing period, the water is boiling sufficiently to maintain a steady temperature within the steam chamber. At the close of the processing period the steam chamber is first opened then the fire is turned out. This order of procedure is very important if the glass jars are to retain their liquid contents.

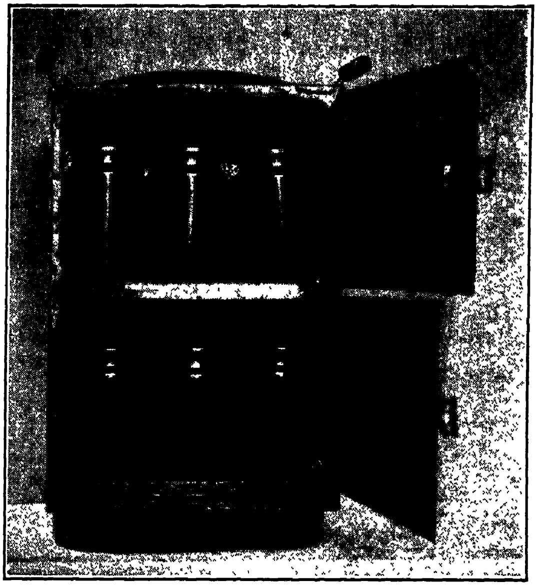

FIG. 12.—A steamer may be used for processing. Note the thermometer at the top.

By observing the above directions the steamer may be used with safety and satisfaction in those sections where water normally boils at 212° F.

The Water-Seal Processer.—This type of processer is more complicated than either of those already discussed. Maximum temperature attained is two or three degrees above that of boiling water and the processing period is therefore shortened somewhat. The construction of the processer is such that the cover telescopes into the vessel to such an extent that the lower edge is below the surface of the water. The food is cooked in steam which can escape from beneath the cover only

by passing through an inch or more of water, then under the edge of the cover and out between the wall of the vessel and the cover. This sets up a slight pressure which raises the temperature a few degrees above boiling water. This processer also should be equipped with a reliable thermometer since the processing is in steam.

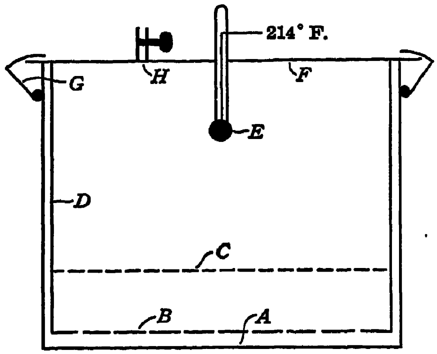

FIG. 13.—The water seal canner.

A, the vessel; *B*, the rack; *C*, the water line; *D*, the wall of the telescoping cover; *E*, thermometer; *F*, the cover; *G*, cover clamps; *H*, exhaust valve.

During the processing the air has been driven out of the steam chamber. As yet no means has been devised to prevent a high vacuum forming within this type of processer at the close of the period, consequently those products requiring long processing usually lose a part of their liquid content. For this reason the water-seal processer is not to be recommended.

The Pressure Cooker.—Steam pressure cookers are so constructed as to carry steam pressure up to 25 or 30 pounds. This will give a range in temperatures from a few degrees above boiling water up to 250° F. at 15 pounds pressure, which is as high temperature as is commonly used. The type of pressure cooker best adapted for use in the home for both cooking and canning is made of aluminum. It is equipped with either thermometer or pressure gage, a safety valve, and a petcock. The aluminum pressure cooker is scientifically constructed and thoroughly reliable and if given proper attention is practically indestructible. It is especially recommended for use in canning the most difficult vegetables and for all meats, poultry, and sea foods. It is the only safe processing equipment for non-acid foods in sections of high elevation (see Chapter VI).

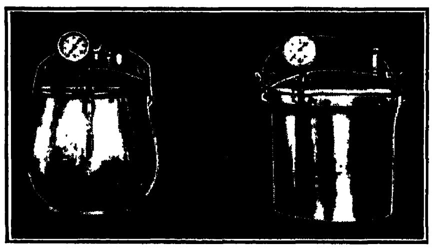

FIG. 14.—Types of Aluminum pressure cookers in common use in home canning.

Properly used, as a cooker as well as a processer in canning, an aluminum pressure cooker will pay for itself within a short time.

Another type of pressure processer is made of steel. These processers are larger and much heavier than aluminum pressure cookers and as a general rule they are not as well adapted to the small canner's needs.

The average kerosene stove will not give sufficient heat to operate these steel processers at 10 pounds pressure. Also it is very difficult to keep them steam-tight. When one is canning in tin cans and has sufficient heat to operate them the steel pressure processers are a good investment, but if canning is in glass the aluminum type is more desirable.

Operating the Pressure Cooker.—In operating the pressure cooker enough water is added to bring the level up to the rack, the jars are set in and the cover is applied. This should be done properly, that is, the mark on the cover should coincide with a similar mark on the vessel itself. The lugs are brought into position and tightened, by going around all of them. When all are snug the petcock is opened and the cooker is set over the fire. When the steam escapes with an audible hiss from the petcock it is closed and heat is applied until the indicator registers the desired temperature or pressure. The flame is lowered somewhat and after two or three minutes may be so adjusted as to maintain uniform pressure. The processing period is timed from this point. If fruits are processed at 10 pounds for less than ten minutes, the petcock is slowly opened at close of processing period for the purpose of quickly exhausting and cooling the cooker. When the steam is all out the cover is removed and the containers may be lifted out. However if the processing period has exceeded ten minutes this procedure would be disastrous with glass jars. When glass jars are used and the processing has exceeded ten minutes the cooker is removed from the fire and allowed to cool until the indicator registers zero. At this time the petcock is gently opened. If no pressure is shown the petcock is opened full—the cover removed and the jars are lifted out.

Fruits may be canned successfully under steam pressure but as a rule the water bath or steamer is more satisfactory.

The safety valve must be given special attention at the close of the day's operation. The valve should be removed and both valve and valve seat wiped dry. A drop of oil rubbed over these parts will prevent rusting. If the valve becomes badly rusted it may fail to function or it will leak; in either event it will be useless.

Source of Heat.—Processing equipment should also include the source of heat. The water bath and the steamer can be successfully used on the wood or coal range. The principal objection to this is the excessive heat in the room, which is very objectionable, especially if the other work of canning must be done in the same room. The steam pressure cooker can be successfully operated on either gas or oil flame, and these are preferable to the range for all types of processers. There is less heat in the room. The heat is more intense at the desired place and it may be instantly regulated.

Oven Processing.—Processing canned foods in the oven is still in the experimental stage. The author does not believe that we have sufficient knowledge, at this time, to warrant making recommendations as to procedure and processing schedules.

MISCELLANEOUS EQUIPMENT

Under this group would be placed such articles as towels, dish cloth, chairs or stools, table space, and any other devices which will help to lessen the labor. The canner is urged to plan the work so that it may be done with the least expenditure of energy and yet be done efficiently.

HOME FACTORY EQUIPMENT

The equipment for the home factory is discussed in Chapter XXVII.

THE FUEL COST OF CANNING

The fuel cost of processing foods packed in glass jars depends upon: (*a*) the kind of products, that is, whether they require a long, medium, or short processing period; (*b*) the size and kind of processer; (*c*) the kind of fuel and rate at which it is consumed; (*d*) the size of the jars; and (*e*) the initial temperature of the water in the processer. In all these tests cold water was placed in the processers.

The data given in the accompanying tabulation have been obtained from many trials using such equipment as may be found in the home canner's kitchen. The following processers were used: (*a*) Two water baths, one of 5 pint-jar capacity, the other for 15-pint jars; (*b*) a two-compartment steamer having capacity of 18-pint jars; and (*c*) two steam-pressure cookers holding 5- and 7-pint jars respectively.

Gas and kerosene were the only fuels available. Because the price of both these fuels varies so much the amount of each fuel rather than the cost is given. It will be relatively simple to change the amounts given to cost figures by using the local prices of gas and kerosene. For example, in Amherst gas costs $2.50 per M (that is, $\frac{1}{4}$ cent per cubic foot), kerosene is 16 cents per gallon or $\frac{1}{8}$ cent per fluid ounce. The amounts given represent the quantity of fuel required to process each pint jar.

Sweet corn, asparagus, and berries were used as representative of a long, a medium, and a short processing period respectively.

FUEL CONSUMPTION PER PINT-JAR

	Cubic Feet, Gas	Fluid Ounces, Kerosene
Large water bath, capacity 15 pint-jars:		
Sweet Corn	5.6	6.5
Asparagus	4.4	5.3
Berries	2.3	3.2
Small water bath, capacity 5 pint-jars:		
Sweet Corn	6.8	8.0
Asparagus	5.6	6.4
Berries	2.5	4.0
Steamer, capacity 18 pint-jars:		
Sweet Corn	3.7	2.4
Asparagus	2.7	2.0
Berries	1.2	1.3
Steam Pressure Cooker, capacity 7 pint-jars:		
Sweet Corn	1.8	
Asparagus	1.5	
Berries	1.0	
Steam Pressure Cooker, capacity 4 pint-jars:		
Sweet Corn	2.8	
Asparagus	2.2	
Berries	1.7	

Including all types and sizes of processers the proportion of total fuel consumed in bringing the water or steam to processing temperature is as follows:

1. Berries—70 to 90 per cent
2. Asparagus—45 to 60 per cent
3. Sweet Corn—25 to 40 per cent

Approximately one-third of this fuel may be saved, when canning in quantity, by using the heated water in the processer for the second and subsequent cookings.

If the cover is left off the hot-water bath during processing it will require approximately 30 per cent more fuel to process berries. This increase would be correspondingly greater with asparagus or sweet corn because water would need to be added to replace that lost through evaporation.

REFERENCES

See Chapter III, Canning.

CHAPTER V

CONTAINERS AND THEIR MANIPULATION

The container is the important item in all canning. There are two types: glass jars and tin cans. The type of container used will determine in a large measure the kind and amount of equipment necessary for economical operation, the methods of packing and processing, the cost of the finished package, and the ultimate cost of those products to the consumer.

The home canner as a rule uses glass jars. Also the small factory operators of the Northeastern states have found glass jars to be best adapted to their work. The initial cost of glass is greater than for tin and there is perhaps greater loss due to defective containers, but the glass jar may be used many times thereby extending its cost over a period of years and making it much more economical for the home canning; in addition, the higher prices received for foods canned in glass jars will justify their use in the small factory. The farm factory has clearly demonstrated the value of the glass jar for local trade. Customers like to see what they buy and an attractive display of goods in glass jars will almost always be an urge upon the purchaser to increase the order.

GLASS JARS

The first essential of any make of glass jars is that they may be depended upon to give a perfect seal. Other things worthy of consideration are: (1) shape, which in many instances may affect ease of packing; (2) clear glass, which is desirable since true values are given to the color of the contents; and (3) a simple and efficient means of sealing.

The glass jar consists essentially of four parts: (1) the jar proper, (2) the cover, (3) the fixture or means for holding the cover in place, and (4) the sealing medium which effects the hermetic seal between the cover and the jar. There are many types of jars on the market but for purposes of this discussion they may be placed into two groups: (1) those that have glass tops or covers and (2) those whose tops or covers are of metal. Jars having glass covers fall naturally into two classes because of nature of the cover fixtures. In the one class the cover fixture is

attached to the jar as in the lightning type, etc.; in the other class the cover fixture is detachable, as in certain trade types. Jars having metal covers are also easily classed in two groups: those whose covers may be applied by hand and those whose covers must be applied by a machine.

The sealing medium in glass jars is either a rubber ring or a composition material. The composition only is used with certain types of metal covers. All glass-covered jars require a rubber ring.

The home canner has little choice of the glass jar she shall use. She must perforce use those offered by the local dealer. The small commercial or home factory canner who uses a sufficient quantity is not so limited because he may deal with the jobber or manufacturer. Where a choice may be had the canner should consider the following points before making a decision: simplicity of construction, economy of time and energy of manipulation, adaptation to the kind of work, and quality and clearness of glass. Some brands of jars are uniformly good, that is, there are few culls among them, showing good factory inspection. Other brands will require much time and labor in testing and culling, which results in loss of both time and containers.

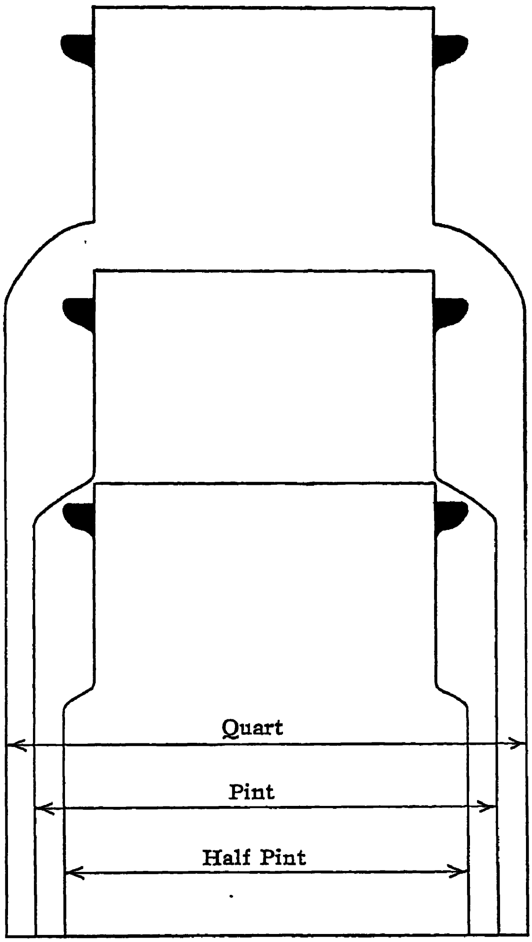

Fig. 15.—The comparative sizes of the commonly used glass jars.

Each type of jar has its own special way of being adjusted for processing. When so adjusted they are said to be "partially sealed," that is, they are closed in such manner as will prevent the cover from becom-

ing displaced during processing and at the same time will permit the escape of expanded air or gases. A few glass jars have recently come on the market so constructed as to eliminate the " partial sealing."

The method of adjusting the more commonly used jars for processing is as follows:

Lightning Type.—The rubber ring is fitted to the sealing shoulder, the cover is placed upon it and the bail is brought over it into the groove or notch in the top of the cover. The bail when properly adjusted should slip into the notch with a slight snap, but not require any marked exertion. If the bail is too tight it should be removed and bent slightly upward in the middle; the sides are bent outward and the bail returned to its place. If the bail is too loose it should be removed and be bent slightly downward in the middle. The sides are pushed inward to restore their natural position, and the bail is returned to its place. When this type of jar is removed from the processer the seal is completed by pushing the lever down against the side of the jar.

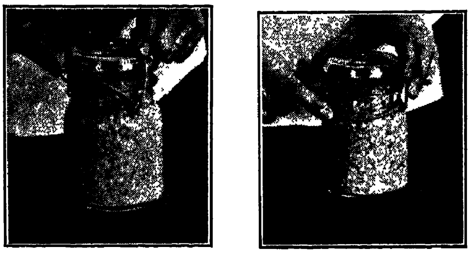

FIG. 16.—Lightning type jar
Left, partially sealed; right, sealed.

The Lever Safety Jar.—The rubber ring is fitted to the sealing shoulder. The cover is placed in position on the rubber. The metal clamp is snapped into position across the top of the jar, leaving the lever in a vertical position. When these jars are removed from the processer the seal is completed by pushing the lever down against the metal clamp.

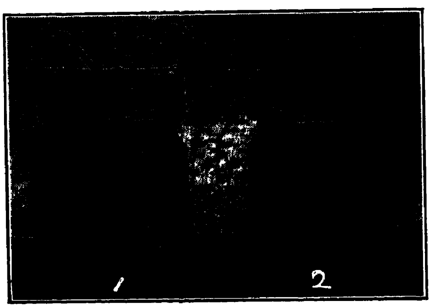

FIG. 17.—The lever safery type jar.
1, partially sealed; 2, sealed.

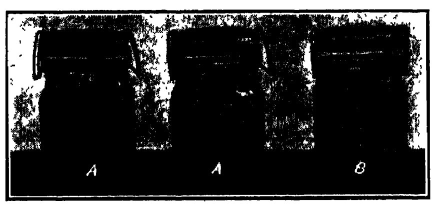

FIG. 18.—Side clamp jars.
A and *A*, partially sealed; *B*, sealed.

Twin Locks or Side Clamp.—This jar differs from the above in that the seal is made at the top of the jar instead of on a shoulder just below

the top. The rubber is fitted to the sealing surface of the cover, the cover is placed on the jar and the side clamps are brought into position on the edge of the cover. The lower ends of the clamps are pressed inward until they almost touch the sides of the jar, or one clamp may be closed against the side of the jar leaving the other slightly loose. When these jars are removed from the processer the seal is completed by pushing the clamp tightly against the sides of the jar.

Improved Side Clamp.—This jar differs from any of the above in that no action is necessary to complete the seal after processing. Two improvements in jar manufacture make this possible: (1) the sealing surface on the cover instead of being smooth has a number of concentric grooves and ridges; these tend to grip the rubber ring, which prevents its blowing out during processing. The cover is held in place by two spring clamps which fit over the edge of the cover at opposite points. In preparing this jar for processing the rubber is fitted to the cover, which is placed in position on the jar, and the spring clamps attached to the jar are brought into position over the edge of the cover and pressed against the side of the jar. When these jars are removed from the processer they require no further action as the seal is already completed.

Screw Cap or Mason Type.—Most of the jars of this type make the seal on a sealing shoulder about three-fourths inch below the top of the jar. A few form the seal at the top of the jar. This last type may have metal, glass, or porcelain tops with a metal fixture to hold the cover in position. The sealing medium may be a ring of rubber or of some composition substance. Those that seal on the shoulder below the top of the jar require a rubber ring. The rubber ring is fitted to the sealing shoulder and the metal cap is screwed firmly down against it, then loosened about a quarter turn. Or the cover is screwed down as tightly as possible using the thumb and one finger only to grasp the cover. When these jars are removed from the processer the seal is completed by screwing the metal cap down firmly against the rubber ring. Jars which make the seal at the top are handled in the same general manner.

Economy Type.—The economy type has a metal cover and the sealing medium is a composition substance in a groove around the outer edge of the cover. The cover is placed in position on the jar and the thin steel spring clamp is snapped into position across the center of the metal cap. These jars require no further action to complete the seal at close of processing period.

Machine-Sealed Jars.—Jars of this type all have metal covers and the seal is effected at the top of the jar or against the smooth sides of

the jar. The sealing medium may be a composition substance or a rubber ring. As a general rule jars of this type are not available for home use. These jars are sealed by placing the cap in position and crimping it in place with a special machine.

TIN CANS

There are two general kinds of tin cans based on methods of closing. They are the cap and hole type and the open top or sanitary type. The open top can is rapidly replacing the cap and hole can in practically all commercial canning. This is due largely to two factors: (1) the natural and growing prejudice of the consumers against foods in soldered cans and (2) the greater ease and speed with which every operation from washing the can to closing it can be performed.

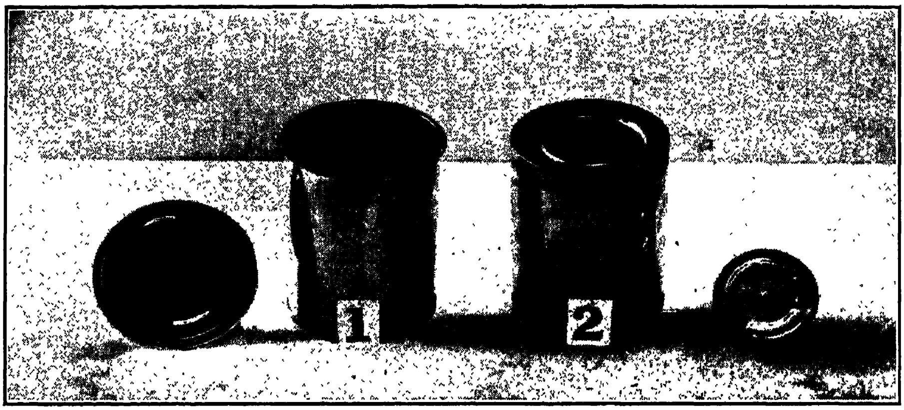

FIG. 19.—Types of tin cans.
1, open top can; 2, cap and hole can.

Tin cans are made in several grades. The cheapest are known as "coke plate" tin, whereas those of the heavier grade are called "charcoal plate tin." Both grades may be had in plain or lacquered tin. The latter are recommended for the small canner's use, since all kinds of foods may be satisfactorily canned in lacquered or enameled cans. Beets and a few of the highly colored fruits lose their color if canned in plain tin.

The small canner or home canner using tin cans should limit his pack to one or two sizes, preferably one. Size number two has a little larger capacity than the pint jar and is adapted to all types of home or small factory canning. Numbers two and one-half and three are approximately the same as the quart jar.

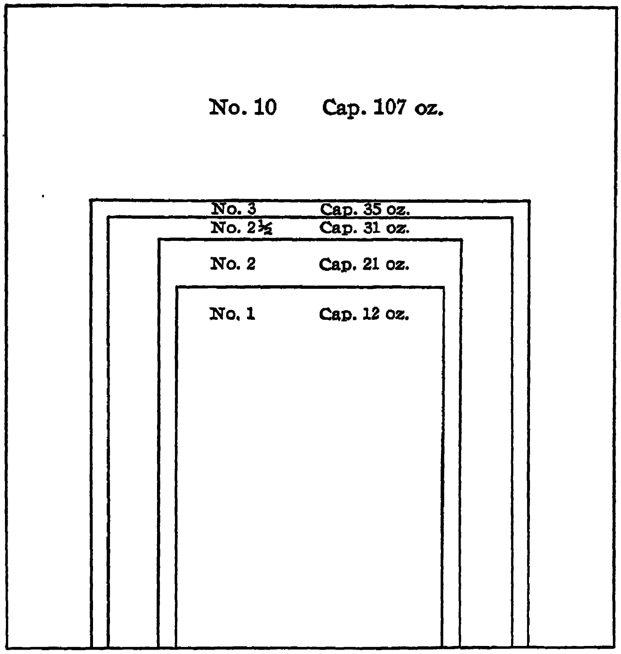

FIG. 20.—Comparative sizes of the most commonly used tin cans. Capacity is expressed in fluid ounces.

The Open Top Can.—The home or small factory canner must rely upon a hand machine to attach the covers to tin cans. These are efficient and with care in keeping the rolls properly adjusted they may be relied upon to do good work. Instructions for operating them accompany each machine. It is only necessary to say here that the closing process consists of two operations. The first operation rolls the edge of the cover and the flange of the can into a tight roll; and the second operation presses this roll tightly and smoothly against the side of the can. The heat of the can and its contents causes the sealing composition to flow into any open spaces and thus effectively seal

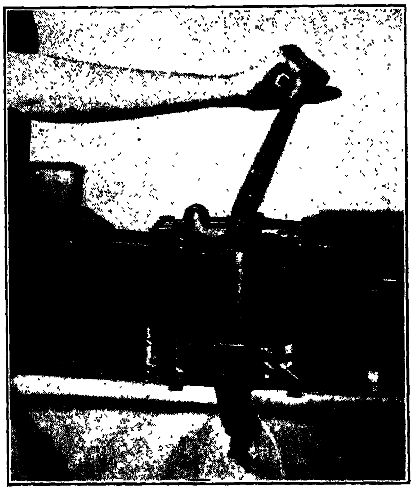

FIG. 21.—A hand power can sealer.

the container. This type of can as it leaves the sealing machine is hermetically sealed.

Cap and Hole Can.—The capping steel should be of the proper size to fit the cap. Caps should have the solder hem. The clean iron is thrust into the flame to be heated. While it is heating the groove in which the cap lies is wiped dry and free from particles of food materials. The cap is placed in position and a mere trace of flux is brushed around the solder hem. When the capping steel is hot enough to melt solder readily it is lifted from the fire. If not clean it is hastily wiped on a cloth or is dipped quickly into and out of a weak solution of sal ammoniac or ammonium chloride and is then set on the can, the sharp edge of the steel resting on the solder hem. The center iron is pushed down against the cap to hold it in place with one hand while the other slowly rotates the steel. As soon as the solder has melted the stick is given a quick rotary motion and at the same time it is lifted free from the cap, which is held in place by the center iron of the capping tool. Almost instantly the solder hardens and the steel is moved to the next can. By rapid action a well-heated steel will solder ten or more caps before becoming too cold.

The small hole in the center of the cap is closed by a drop of solder from the soldering copper. The soldering copper should not touch the cap lest it become heated above the soldifying point of the solder which, being melted by the hot iron, will run through the hole into the can. The soldering copper as well as the capping steel should not be overheated and they must be kept scrupulously clean. The function of the ammonium chloride solution is to assist in this. A piece of cloth or bagging may also be used to wipe the tools clean. If they become badly incrusted a flat file will be useful in getting them into shape again. Both the capping steel and the tipping copper must be kept well tinned, that is, their working surfaces must be smooth and well covered with solder. These tools may be "retinned" in the following manner: They are first scraped or filed clean, then heated to a temperature sufficient to melt solder. The hot iron or copper is then placed in a mixture of dry ammonium chloride, two parts, and scraps of solder, one part. The tool is moved about in this mixture until that part of it which comes in contact with the solder is smooth and shines like new tin. The tool is then dipped into the flux, wiped, and is ready for use.

TESTING CONTAINERS

Glass Jars.—The home canner should carefully inspect glass jars for imperfections before packing them. The jar should be looked over for cracks and bubble holes. The sealing surface must be smooth and

free from cracks, shrends and projections which would prevent sealing. These may be detected easily by passing a knife edge or the finger nail over the sealing surface. The cover should be examined in the same way. If both the sealing shoulder and the cover are perfect planes the cover will not rock when placed on the jar. If the cover rocks very much it will not seal the jar.

If the screw cap type of jars are used the edge of the cap which comes in contact with the rubber must be smooth. Any irregularities will prevent the sealing of the jar.

Rubber Rings.—In those types of jars using them the rubber rings are very important. Only the best new rubbers should be used. A good rubber is somewhat soft and elastic. When stretched out to about four to five inches it should return to its normal size. When bent sharply upon itself and pressed together between thumb and finger it should show no sign of cracking or breaking.

Sealing Composition.—The sealing composition should be soft, plastic, free from cracks, and must form a continuous ring around the cover.

The small factory operator who uses a nigh quality container may not need to give this careful inspection to each of his jars. But he should check up on them and the sealing medium frequently.

WASHING CONTAINERS

All containers and their covers should be given a thorough washing before they are packed. Jars that were used the previous season and that have been stored in a damp place are likely to contain mold growth on sides or bottom. Such jars should be given extra attention in order to insure clean wholesome containers. New jars and tin cans almost always contain dust or other undesirable materials. A thorough washing and rinsing in hot water will remove all dust and dirt. The importance of having clean containers in which to pack the foods cannot be over-emphasized.

PACKING THE CONTAINER

Specific directions for packing are given with the discussion of each canned product. For that reason only a few general principles will be discussed here.

1. The solids should be packed into the container as firmly as is compatible with appearance and safety in processing. Tight packing in the neck of glass jars should be avoided. Nor should large pieces of materials be crowded into the top of glass jars so tightly that they

practically function as a stopper or cork. In a given lot of containers of the same size each should be packed with the same amount of materials.

2. As a rule vegetables should not be prepared and packed far in advance of processing. But if packed vegetables must stand for an hour or more before processing they should be filled with cold liquid and contents of jars should be kept as cool as possible. Hot liquid will raise the temperature of the packed vegetables up to the point where the flat sour bacteria are most active. As a result many packages may be soured before they are processed. The work should be planned so that long waiting periods do not come between packing and processing.

3. Tin cans must be packed hot or the filled containers must be given an exhaust before they are sealed, that is, the packed cans are set in a water bath with the water within one-half inch of the top and the water is heated to 190° to 200° F. for 8 to 10 minutes. They are then removed and sealed while the contents are hot. If a sufficient amount of boiling liquid is added to the cans and they are sealed at once the exhaust may be omitted. The canner must remember that air can not be expelled from the tin can during processing as is the case with the ordinary types of glass jars. It is therefore necessary to expel the air, by heating, before the cans are sealed.

4. Glass jars that are commonly used in the home do not require the exhaust before processing. They may be packed with cold materials and the syrup or other liquid added may be either hot or cold. As a general rule, however, hot liquid will be more satisfactory. Such jars as these are not sealed at the time of processing; consequently any included air is expelled during the processing period.

Glass jars that are hermetically sealed by machine must be manipulated in the same manner as tin cans.

OPERATIONS AFTER PROCESSING

After the containers are removed from the processer they require some attention. General practices are noted here but any special requirement will be taken up in connection with the specific product.

Sealing.—The glass jars should have the seal completed immediately upon removal from the processer; provided, of course, they are of the type which enter the processer partially sealed. (See methods of manipulating glass jars, pages 48, 49.)

Examination for Leaks.—Jars which leak slowly will show accumulations of bubbles or froth at top of jar after standing a short time. Jars that leak so badly as to have little or no vacuum will show loss of liquor if inverted in the hand.

Cooling.—Jars should not be set in a cold draft upon removal from the processer. They should be spaced, allowing free circulation of air to induce rapid cooling. They should not be stored until cooled to room temperature.

Position of Jars During Cooling.—There is no particular advantage in laying jars on the side or standing them on the covers during the cooling period, and there are some disadvantages in this practice. It is therefore advisable to leave jars upright.

FIG. 22.—Jars arranged for cooling after processing.

Tin Cans.—As a general rule tin cans are cooled at once by placing them in cold water. They should be removed from the water while they still retain sufficient heat to cause them to dry quickly.

Storage.—All canned foods will keep better if stored in a cool place. It is a good practice to store in the cellar each day the output of the previous day. Warm storage causes rapid deterioration of the food and losses always run high in a warm storage room.

Treatment of Unsealed Containers.—Just what shall be done with the unsealed containers will depend upon the cause. If the rubber or cover is the defective part it may be quickly replaced and if the product is a fruit and still hot a minute or two in the water bath will preserve it. If it is a non-acid food it should be reprocessed approximately one-fourth to one-third the regular processing period. If the jar is defective the product would require repacking. It is doubtful if this will be profitable since the re-processing would need to be of approximately the same length as a normal period for that particular product. Few foods will stand up under such treatment.

STANDARD PACKS

Much has been written about standardizing the pack of the home canner. Both time and energy have been expended freely in trying to arrive at some definite recommendation for the guidance of home canners. The establishment of a usable, standard pack for use in the home and small factory would go far toward solving some of the canner's most perplexing problems. (1) It would then be a simple matter to develop a rational processing period for every product canned. (2) Instructions for packing could be given in definite terms

as, for example, so many ounces of solids and so many ounces of liquid for each and every product canned. (3) The losses from spoilage due to over-packing and under-processing would be reduced to a negligible minimum.

The insuperable obstacle which has always baffled the advocates of a standard pack is the fact that there is no standard package. The so-called pint-jars which are available to home and small factory can-

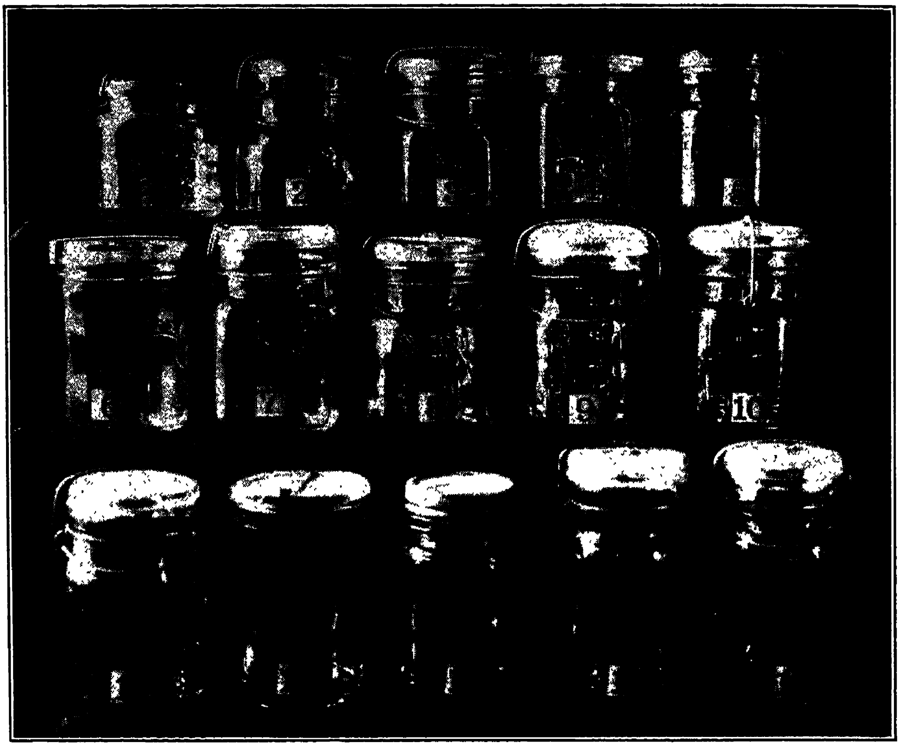

FIG. 23.—Types of pint jars in common use. The numbers correspond to those in the table on page 57.

ners vary widely both in dimensions and capacities. The data on page 57 show fifteen glass jars commonly sold as pint-jars most of which are available for use by the home canner. A casual study of these data will show how impossible it is to set up a standard pack for pint-jars that have such a wide range in their respective capacities. It is possible to pack this assorted lot of jars with a standard amount of food per unit capacity. The fact still remains that since the jars vary so widely in their diameters a rational standard processing period is impossible.

So long as the small canner must work with jars of such varying sizes just so long must instructions for packing and processing be empirical. This means that the home canner must apply more intelligence to every operation than would be necessary if standardized packs were possible. If any errors are made they should be on the side of slack packing and over-processing.

The range in diameter and capacity of the various types of pint-jars in common use in the home and in the farm factory is shown in the table, and accompanying illustration.

VARIATION IN SIZE OF PINT-JARS

No.	Diameter, Inches	Capacity, Ounces	No.	Diameter, Inches	Capacity, Ounces
1	$3\frac{12}{16}$	18.0	9	$3\frac{6}{16}$	19.5
2	$4\frac{1}{16}$	20.5	10	$3\frac{7}{16}$	20.0
3	$3\frac{5}{16}$	16.5	11	$3\frac{6}{16}$	19.0
4	$3\frac{4}{16}$	18.0	12	$3\frac{3}{16}$	17.0
5	$3\frac{9}{16}$	20.0	13	$3\frac{3}{16}$	16.5
6	$3\frac{6}{16}$	19.0	14	$3\frac{5}{16}$	20.0
7	$3\frac{5}{16}$	20.5	15	$3\frac{2}{16}$	18.5
8	$3\frac{8}{16}$	18.5			

REFERENCES

See Chapter III, Canning.

CHAPTER VI

THERMOMETERS AND TEMPERATURES

The thermometer is a useful piece of equipment when properly manipulated and intelligently interpreted. There are two types in general use. (1) The Fahrenheit thermometer is the one commonly found in the home and factory. It is graduated to indicate the freezing point of pure water at 32° with zero point 32° below freezing, and the boiling point is 212° above the zero point or 180° above the freezing point. (2) The Centrigrade thermometer is the one used in most scientific and experimental work. It is graduated to record the freezing point of pure water at 0° and the boiling point at 100° above the freezing point. It is evident therefore that 100 degrees Centrigrade are equivalent to 180 degrees Fahrenheit. By means of the following formulas it is easy to convert Centigrade reading into Fahrenheit reading, and vice versa:

$$\frac{(\text{Degrees Centigrade} \times 9)}{5} + 32 = \text{degrees Fahrenheit}$$

$$\frac{(\text{Degrees Fahrenheit} - 32)}{9} \times 5 = \text{degrees Centigrade}$$

The student will often find, in the current literature, references made to one or the other of these thermometer readings. By substituting in the above formulas the given reading may be changed to that recorded by the thermometer used.

THE THERMOMETER AND ITS USES

Testing the Thermometer.—Thermometers should be tested occasionally. This may be done by placing them in a vessel of boiling water. The temperature recorded by the thermometer should be taken as the boiling temperature on that particular thermometer. This temperature may vary over a range of approximately two degrees Fahrenheit depending upon weather conditions (see page 61). As a general rule this local fluctuation is disregarded in practical work but must be taken into account in all scientific calculations.

Kinds and Types of Thermometers.—There are many grades and kinds of thermometers ranging from the highly sensitive and complicated self-recording types used in factory operations down to the simple inexpensive and often unreliable household thermometer. Thermometers used in the kitchen and small factory may be placed in three groups depending upon their mechanical construction: (1) Those which have the graduations engraved upon the glass stem of the instrument; (2) those which have the graduations marked on a metal plate to which the glass tube is attached, and (3) those that have the graduations marked on a paper enclosed within a glass tube surrounding the stem of the thermometer.

Correcting the Thermometer.—After a period of service the graduations marks on thermometers in group 1 may become obscure and difficult to read because the color has gradually been lost from the marks in the glass. This may be remedied by cleaning the glass tube and rubbing a wax pencil up and down the thermometer over the degree marks. The thermometer is wiped clean and the graduations will be as sharply defined as when the instrument was new.

Thermometers in group 2 often give trouble because the fastenings which attach the tube to the plate may become broken or loosened. This allows the tube to move up and down the plate a distance of one or more degrees. Such displacement will naturally cause the thermometer to record false readings. Instruments of this type should be examined to determine if the stem or glass tube is firmly fitted to the metal plate. If it is loose the thermometer should be tested by placing it in a vessel of boiling water. The tube may then be adjusted to the proper position on the plate and the fittings may be tightened to hold the stem firmly in place.

The paper within the tube in thermometers in group 3 may become loosened and will then move up or down the tube far enough to render the instrument practically worthless. There is no simple way of correcting this difficulty.

Occasionally the mercury column within the tube becomes broken, that is, a small segment of the thread of mercury becomes detached from the main column and persists in moving up and down the tube at a distance of a few degrees from the main portion of the column of mercury. This trouble can generally be corrected by grasping the thermometer in the hand, bulb downward. The hand is brought almost to the horizontal position and is swiftly moved downward to stop suddenly at or near the vertical. This sudden jar will usually reunite the parts of the broken column of mercury and the thermometer will then be as good as when new.

Taking Temperatures.—The bulb of the thermometer should be completely exposed to the action of the material which is to be tested. This is especially desirable if the material is of a pulpy consistency. It is difficult and often impossible to get an accurate temperature reading with a thermometer whose bulb is covered with a metal guard or whose bulb is submerged in a small hole in the wood or metal mount of the thermometer. Such thermometers will function properly in liquids but when pulps are to be tested they are not dependable.

Thermometer Holder.—The thermometers in group 1, commonly called chemical thermometers, should be fitted to a wood holder for most efficient and satisfactory use. A simple holder which may also be used as a stirrer is shown in illustration page 34. It is made of white wood or any other tasteless wood. It is a half-inch thick by two inches in width. Its length should be an inch or two greater than that of the thermometer. A triangular piece is cut out of the lower end, the apex of which extends about 1½ inches up the holder. The width of the base of the triangle is one inch. Across the holder just above the apex of the triangle is a cross piece with a hole in the center. The thermometer passes through this hole with the bulb resting within the triangular opening. A knife-cut in the upper end permits a string which is attached to the upper end of the thermometer to be drawn tight enough to hold the instrument in position. This arrangement will be found to function most satisfactorily. The bulb of the thermometer should not be allowed to rest on the bottom of the vessel during the cooking period.

The thermometer should be placed in the cooking materials and left in until the finish temperature is obtained. If the vessel is of sufficient diameter to project an inch or two beyond the opening in the gas plate or oil stove and if the material is of a viscous consistency the temperature of the boiling materials will be highest in that portion of the vessel directly over the flame. Hence a thorough mixing of the cooking materials, before reading the temperature, is necessary for accuracy.

THE BOILING POINT

Pure water in an open vessel or in a vessel fitted with an ordinary type of cover boils when heated to such temperature that the internal pressure of the vapor produced by heating the water equals or very slightly exceeds the atmospheric pressure upon its free surface. When this condition prevails the steam formed in the water escapes in large bubbles giving the characteristic tumbling or rolling of the water commonly recognized as boiling.

The temperature of the water in open vessels cannot be raised above the boiling point by increasing the amount of heat. Addition of heat more than that necessary to maintain slow, even boiling will cause more rapid boiling and increase the rate of evaporation.

Boiling Temperature as Related to Pressure.—Any appreciable variation in the atmospheric pressure will cause corresponding variations in the boiling point.

Relation between the Boiling Point of Water and the Atmospheric Pressure

(*Adapted from Smithsonian Meteorological Tables*)

Atmospheric Pressure Expressed in Inches of Mercury	Temperature of Boiling Water, Degrees Fahrenheit	Atmospheric Pressure Expressed in Inches of Mercury	Temperature of Boiling Water, Degrees Fahrenheit
19	190	24.4	202
19.4	191	24.9	203
19.8	192	25.4	204
20.3	193	25.9	205
20.7	194	26.5	206
21.1	195	27.0	207
21.6	196	27.6	208
22.0	197	28.1	209
22.5	198	28.7	210
23.0	199	29.3	211
23.5	200	29.9	212
23.9	201	30.5	213

By reference to this table given herewith it will be noted that a fall in atmospheric pressure of approximately one-half inch of mercury lowers the boiling point of water by one degree Fahrenheit. Knowing the general average pressure at any place, the boiling point of water may readily be determined by reference to the table, or vice versa.

Effect of Elevation.—The average temperature of boiling water at or near sea level under the normal atmospheric pressure of 30 inches of mercury is 212° F. The boiling point is lowered approximately one degree for each 550 to 600 feet of elevation above sea level, due to decrease in atmospheric pressure. The next table, which has been compiled from various sources, illustrates the relations which exist between elevation and the temperature of boiling water.

EFFECT OF ELEVATION ON BOILING TEMPERATURE

Place	Elevation	Approximate Average Barometer Reading, Inches	Approximate Temperature of Boiling Water, °F.
Boston, Mass.	Sea Level	30	212
Bozeman, Mont.	4,754	25	202
Laramie, Wyo.	7,165	23	198
Reno, Nev.	......	25.4	204
State College, N. M.	......	26.2	205.3
Tucson, Ariz.	2,400	27.6	208
Mt. Blanc, Switzerland	15,800	16.7	184

Boiling Temperature as Related to Food Preservation.—When we apply the above facts to the business of food preservation it becomes apparent that it is impossible to formulate a time table for water bath processing in canning or a schedule of finish temperatures for manufactured food products, that will be applicable throughout the country. The canner must remember that it is the heat units—the temperature applied throughout a given period—that preserves canned foods, not the mere fact that the foods have been subjected to the temperature of boiling water. Rational time tables for processing canned foods in the water bath are based upon a temperature of approximately 212° F. These time tables are therefore not applicable to those sections in which water boils below the normal temperature of 212° F.

LIMITATIONS OF WATER-BATH CANNING

It is very doubtful if the water bath or steam bath should be used for processing the non-acid foods at elevations of more than 1000 feet above sea level. The boiling point of water is too low to give a sufficient degree of safety. This is especially true if the operator is guided by the ordinary processing time tables. The home canners who live in the more elevated sections of the country and who desire to can the non-acid foods may make use of one of two measures, the pressure cooker and the brine bath.

The Steam Pressure Cooker.—This type of processing equipment (see page 42) which has recently come into general use for both cooking and canning is equipped with a pressure gage, that records with reasonable accuracy the temperature, above 212° F., within the cooker

regardless of the elevations. The pressure cooker therefore offers the greatest possible degree of safety for canning all non-acid foods.

Use of Salt.—It is a well-known fact that when salt is dissolved in water the boiling point of the brine, thus formed, is raised above that of pure water. The increase in boiling temperature is directly proportional to the density of the brine, that is, to the amount of salt dissolved in a unit volume of water. For all practical purposes the home canner may assume that the temperature of the water in the water bath is raised 1° F. for each 3 ounces of salt, per gallon, dissolved in the water. For example, if the boiling temperature of water at a given place is 208° F. the addition of 12 ounces of salt for each gallon of water in the processer will raise the boiling temperature of the resulting brine to 212° F.

There are however some objectional features to the use of brine as a processing medium. (*a*) The salt corrodes the tin cans and also the tin processer. (*b*) Glass jars must be given a thorough washing after cooking to remove the coating of salt. (*c*) Wherever drops of the brine are permitted to dry on the floor and tables a deposit of salt crystals is formed. (*d*) As the water evaporates from the vessel during the processing the temperature steadily increases due to a greater concentration of the brine. This last fact is not a serious matter since the slight increase of 2° to 3° F. in the processing temperature will not cause any injury to the foods and it is a little added insurance that the foods will keep.

The brine may be stored in a keg or earthen vessel and used many times provided it is diluted to conform to the proper temperature. A thermometer should be used to determine the actual boiling point of the brine. The home canner cannot afford to leave anything to "guess work."

THE FINISH POINT

The finish temperature of any concentrated fruit products, candies, syrups, etc., is considerably above the boiling temperature of water. The finish point varies with (*a*) the degree of concentration and (*b*) the atmospheric pressure. In order to state the finish temperature of any given food, which shall have a fairly uniform application, it may be expressed more accurately as so many degrees above the boiling point of water. For example, the finish point of currant jelly at or near sea level is 219.5° F. or 7.5° F. above the normal boiling temperature of water. If current jelly is made at higher elevation its finish point will be 7.5° F. above the temperature of boiling water at that place. This principle applies to the manufacture of all concentrated foods.

INTERPRETATION OF LITERATURE

In practically all the literature where unqualified finish temperatures are given the reader must assume that they are sea level temperatures. The difference between the stated temperature and 212° F. will be the number of degrees above the average temperature of boiling water at sea level. This difference added to the temperature of boiling water at any elevation will be the finish temperature for that particular product at that elevation.

CHAPTER VII

CANNING FRUITS

Fruits may be canned for use as dessert, for culinary purposes, or for subsequent use in some manufacturing process. When canned for dessert they are, with few exceptions, sweetened sufficiently for immediate use; if canned for other uses they may or may not be sweetened, since the sugar can be added as well or better at the time of using.

METHODS OF CANNING

Depending upon their character and the use to be made of them, fruits may be canned by any one of the following methods:

1. With sugar syrup.
2. With water or fruit juice.
3. With sugar only.
4. Without anything added:
   (*a*) By blanching.
   (*b*) By close packing.

Canning in Syrup.—A canning syrup is a solution of cane sugar in water. Its density depends upon the amount of sugar in a given weight of the syrup. Density is expressed in terms of percentage of sugar in solution.

All hard fruits and most of the soft fruits, if intended for dessert alone, should be canned with sugar syrup. In this way the fruit comes from the package ready to serve without any subsequent treatment. The color and quality are of the best and the syrup and fruit are in proper proportion for serving.

The density of syrup to use is determined by: (*a*) the acidity of the fruit, (*b*) the closeness of the pack, and (*c*) the taste of the consumer. It is well to keep in mind that fruit may be easily over-sweetened if syrups of too great density are used; also that if the pack is a solid one heavier syrup must be used to secure the desired taste. In order to secure a uniform grade of canned fruit it is necessary to establish a standard pack and to use standard grades of syrups using those syrups

which are adapted to develop the highest quality and best flavor in each kind of fruit.

Standard grades of syrups are made by dissolving a known amount of sugar in a given volume of water. The sugar and water are placed in a vessel and heated only until the sugar dissolves. The exact density of the syrup may be determined by the use of a saccharometer. There are two types of these to be had—the Balling saccharometer, which gives a reading of from 0 to 70 per cent sugar, and the Brix saccharometers, which come in sets of two, one of which gives a 0 to 30 per cent reading while the other gives 30 to 60 per cent. An instrument of this nature is very useful, especially to the operator of a small factory or even in the home where a large amount of canning and preserve-making is carried on. Saccharometers are not, however, necessary except where exact results are required. For ordinary canning close approximations may be made by careful measurements of sugar and water.

The following brief table for use in making canning syrups is based upon weights of both sugar and water, but volume measurements if carefully done will give sufficiently accurate results for all practical purposes. If volume measurements are used the sugar should be well settled in the measuring cup and one slightly rounded pint be allowed to equal one pound. A pint of water is equal to one pound for this purpose.

Sugar, Parts	Water, Parts	Syrup, Per Cent of Sugar	Approximate Amount of Sugar in One Cup of Syrup, Ounces	Approximate Amount of Syrup From One Pound of Sugar, Pints
1	4	20	1.77	4.5
1	2⅓	30	3.00	2.7
1	1	50	4.70	1.7
1½	1	60	6.15	1.3

The amount of syrup required to pack a pint jar of fruit will depend largely upon the size of fruits or pieces of fruit and the closeness of the pack. A close approximation will allow one-half to three-fourths cups per pint jar. If the fruit is very closely packed the density of the syrup must be increased in order to carry into the jar sufficient sugar to give the desired taste.

NOTE—For more detailed study of syrups the reader is referred to the syrup chart, with discussion, on page 78.

Canning with Water or Fruit Juice.—When sugar is high priced the fruits may be canned by substituting water or fruit juice for syrup. Canned in this manner they may be used for all culinary and manufacturing purposes and if sweetened before serving many fruits will be equally good for dessert. As a general rule most fruits retain their shape and natural color a little better if canned in syrup.

Canning with Sugar Only.—Some of the soft fruits may be canned by the addition of sugar only. This method is particularly adapted to canning strawberries.

Canning without Addition of Other Materials.—Many fruits which are to be used for culinary or manufacturing purposes may be very satisfactorily canned without adding anything to them. There are two general methods: (*a*) blanching and (*b*) close packing.

(*a*) *Blanching.*—The fruit is blanched in boiling water just as long as possible without appreciable loss of juice; cold dipped, well drained and packed tightly into containers. This method is especially adapted to such fruits as blueberries, currants, and raspberries.

(*b*) *Close Packing.*—Juicy fruits such as grapes and pitted cherries will set free sufficient juice to fill the jars if the fruit is closely packed. If care is used in the packing very few of the fruits will be crushed.

THE FRUIT AND ITS PREPARATION

Condition of Fruit for Canning.—All fruit should be well ripened before it is canned. Unripe fruit is low in quality, the texture is hard, the taste is too acid, and the natural flavor and aroma have not developed. On the other hand if the fruit is much over-ripe it will crush easily and will not give an attractive looking package. Fruits that are in their prime condition to eat out of hand are as a general rule best for canning.

When fruits are being canned in sufficient quantity they should be graded for size, color, and ripeness. Soft and over-ripe fruits should be discarded for use in jams, butters, or blended jellies.

Preparation and Handling.—All fruit from which the skin is removed or which is cut into pieces will discolor within a very few minutes if exposed to the air. This discoloration may be prevented by placing the peeled or sliced fruit in either a weak brine (one tablespoon salt per quart of water) or a light sugar syrup (1 cup sugar per gallon). The syrup may be strained after using and concentrated to be used as a part of the canning syrup.

Soft fruits like the berries should be washed just before packing. If allowed to stand long after washing they become soft and unfit for

canning. Strawberries should have the calyxes or "hulls" removed before the fruit is washed.

Packing the Fruit.—Large fruits like plums, pears, and peaches must be placed in the jars rather than just "filled in" if a close and attractive pack is desired. A narrow-bladed spatula or a thin wood paddle will be found almost indispensable in placing and arranging these fruits in the jars. The aim of the canner should be an honest economical pack rather than just a showy pack.

Small fruits like berries and cherries are shaken down to form as close a pack as possible without crushing the fruit. The jar is filled, loosely, to the neck with these small fruits. It is then grasped about the neck and is struck downward on the palm of the other hand or on a folded cloth on the table two or three times. It is filled again and settled, after which fruit is added to fill the jar rounded full.

Adding the Syrup.—The syrup should be added as soon as the jars are packed. There are some distinct advantages in adding hot syrup: (1) There are fewer air bubbles left among the fruits, since the heated syrup expands the air, causing the bubbles to rise to the top of the container; (2) the jar is warmed somewhat and may more safely be placed in the heated water in the processer.

If the syrup is added to within a half inch of the top of the container and if the container is then swiftly rotated first in one direction and then the other, the imprisoned air among the fruits will be expelled. Or a thin, flexible spatula may be used to release the imprisoned air. More syrup is then added to fill the jar full. It is highly essential that the packed jars shall be as free as possible from air bubbles before they are placed in the processer.

Removing Peel or Skin from Fruits.—A few suggestions for removing the peel from some of the more important large fruits should be of interest, at least to the inexperienced.

Apples are peeled most rapidly by use of a peeling machine. There are many kind of these, ranging from the single-fork kitchen peeler to the three-fork hand or power peeler and corer. Pears are as a rule not adapted to peeling on machines. Hand peeling gives best results. Commercial canners use a knife with a curved blade having a guard to limit the thickness of the peel. These are very desirable since they give a smooth surface to the peeled fruit. If pears are to be canned in halves they may be most easily cored by using a pear corer or a potato ball cutter.

Peaches may be peeled with a knife, scalded, or lyed. Lye is the most economical way to remove the skin from the peach, provided one is handling as much as a bushel or more of fruit. The fruit is placed in

a wire basket and lowered into a kettle of boiling lye solution (1 pound of ordinary concentrated lye per gallon of water) for 30 to 60 seconds or just long enough for the lye to remove practically all the skin but not long enough to soften the fruit. The fruit is immediately washed through several changes of water, or better is set under the running tap. A few minutes' washing to remove the lye and a little gentle rubbing to loosen adhering bits of skin will in a very short time peel a large amount of fruit. Fruit peeled in this way should be kept in a weak brine until ready to pack. If fruit is difficult to pit the pits

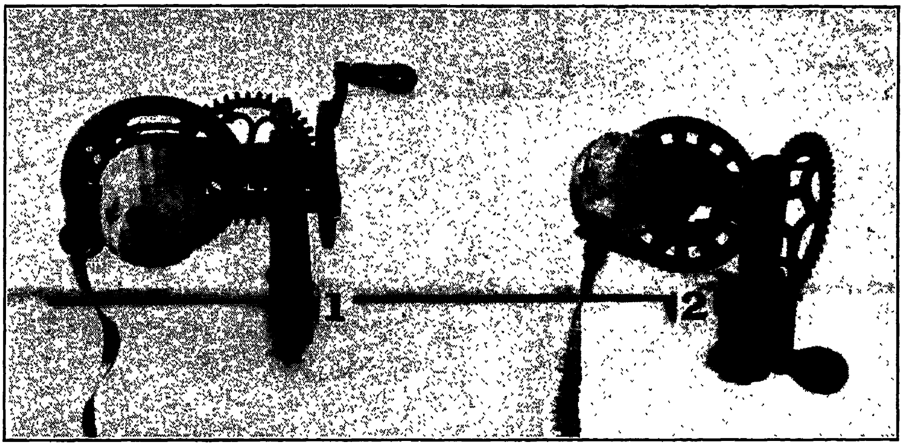

FIG. 24.—Two types of kitchen apple peers.
1, circular rotating knife; 2, flat knife.

should be removed before peeling, as this operation can be done more readily if the skins are on the fruit.

If preferred the fruit may be blanched in hot water just long enough to cause the skins to slip readily, after which they must be cooled at once in cold water.

Plums are most easily skinned by placing them in a wire basket or cheesecloth and dipping them into a kettle of boiling water just long enough to loosen the skins, then quickly cooling them in cold water to prevent unnecessary cooking of the pulp.

RECIPES FOR CANNING FRUITS

APPLES

Any good cooking apple, especially the fall and winter sorts, may be canned. Summer apples as a rule are soft and juicy and are best canned in the form of sauce. The fruit should be of good quality, well

ripened but not mellow. Most varieties may be canned either in pieces or as a sauce, depending upon the use to be made of them. Each method of canning will be treated separately.

Canned Apples—Sliced.—The fruit is peeled, cored, and cut into thin slices: usually the quarters are cut lengthwise into three or four pieces. The slices are placed in a weak brine (one tablespoon of salt per quart of water) until the fruit is all prepared.

When the fruit is all prepared the slices are removed from the brine, placed in a cheesecloth and are blanched for 8 to 10 minutes in water heated to a temperature of 180° to 190° F. They are cooled in cold water and should be left in the cold water for 5 to 10 minutes. When thoroughly cooled they are packed moderately tight into clean, dry containers and covered with 20 per cent syrup. The jars are sealed and then processed in the water bath for 12 minutes.

Canned Apple Sauce.—The trade recognizes two types of sauce—strained and rough or uneven. The latter is as a rule better quality and is the one recommended here. If a fine sauce is preferred it may be run through a colander or fine sieve before filling.

The apples are peeled, quartered and cored. The prepared fruit is placed in a weak brine until ready to cook. The fruit is removed from the brine and thoroughly rinsed in cold water to remove the excess salt. A syrup is made by dissolving 3 to 4 ounces of sugar per pound of prepared fruit in one-fourth cup of water. The fruit is cooked in this syrup in batches up to six or eight pounds. Cooking proceeds at moderate to slow boiling in a closely covered vessel for 6 to 8 minutes. At the end of this period the cover is removed and cooking is continued at moderate boiling. The fruit is gently stirred a few times to prevent scorching. When there is no free liquid noticeable the sauce is finished. If froth is present the fruit is cooled and stirred until clear. The hot sauce is filled into clean, dry jars, filling them full. The jars are partially sealed and processed in the water bath for 8 to 10 minutes for pint jars. At close of processing the jars are removed, sealed and allowed to cool before storing.

The following data may be of interest to the sauce maker. One pound of prepared fruit will yield approximately one pint of sauce. The following averages of scores of trials are fairly reliable. The waste as peel, core and cut out for the various market grades of apples varies according to sizes within the grade but if a medium size is considered the figures are as follows: A grade 20, B grade 25 per cent, unclassified 30 to 35, culls up to 45 or 50 per cent.

Blueberries

Blueberries may be canned in syrup, in water, or without anything added to them. This last method gives such a superior grade of canned fruit that only this method is given.

The berries are looked over and all foreign material is removed. The prepared fruit in lots of one or two quarts is placed in a cheesecloth bag and blanched by lowering the bag into the boiling water. The fruit is left in the hot water until a few spots of color on the cloth show it is beginning to lose juice, usually 20 to 30 seconds' blanching. Then it is immediately cooled in cold water, drained and packed, as tightly as possible without crushing, into clean, dry jars. The jars are partially sealed and are processed in the water bath for 12 to 15 minutes for pint jars. After processing the jars are removed, sealed, and cooled before storing.

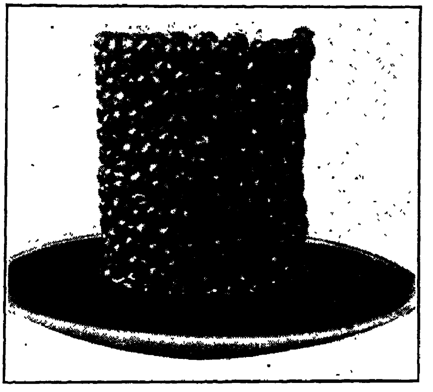

Fig. 25.—Blueberries canned without addition of sugar or syrup.

About three-fourths of a quart of fruit will be required to pack one pint jar. If jars are not filled to the top when cold they were not packed tightly enough or the berries were under-blanched.

Blackberries

Blackberries are at their best only when fully ripened. The fruit is washed, drained, and packed, as tightly as possible without crushing, into clean, dry jars. The jars are filled with hot 30 to 50 per cent syrup. They are partially sealed and processed in the water bath for 15 minutes for pint jars, 18 minutes for quart jars. After processing jars are removed, sealed and cooled before storing.

Cherries

Sour cherries may be canned either with the pits in or pitted. If the pits are not removed the fruits are picked from the stems, washed, drained, and packed as tightly as possible without crushing into clean, dry jars. They are covered with hot 50 per cent syrup, the jars are partially sealed and processed in the water bath for 15 minutes for pint jars.

Cherries may be pitted fairly rapidly by means of the small hand pitters. These machines tend to break up the fruit and if fruit is intended for dessert hand-pitting is preferred. A thin wire loop similar to a hairpin or a wire paper clip may be inserted at the point where the stem was attached and the pit is removed without serious injury to the fruit. A little practice and one may become quite expert with this method of pitting cherries.

These pitted fruits are packed lightly into clean, dry jars and covered with 50 to 60 per cent syrup. The jars are partially sealed and processed in the water bath 15 minutes for pints. It requires about three-fourths quart of fresh cherries to pack one pint jar. If more fruit is crowded into the jar there is not space for enough syrup to sweeten the fruit.

Cranberries

As a rule cranberries are made into sauce before canning. Three types of sauce are common: whole fruit sauce, chopped sauce, and strained sauce. The chopped sauce is generally preferred.

Whole Fruit Sauce.—The berries are washed and then boiled in a covered vessel with one quart of water for each pound or quart of fruit. When the berries are well broken up the cover is removed and sugar at the rate of 1 to 1¼ pounds per quart of fruit is added. Rapid boiling is maintained for a few minutes until the syrup almost gives the jelly test, or to a temperature of 216–217° F.

Chopped Sauce.—After washing, the berries are run through the food chopper using the medium cutter. Water in the ratio of one quart per pound of fruit is added and the fruit is boiled slowly in a covered kettle for 10 minutes. Sugar at the rate of 1 to 1¼ pounds per pound of fruit is added and boiling is continued in the open kettle until the syrup will almost give the jelly test, or to 216–217° F.

Strained Sauce.—In preparing strained sauce the procedure is the same as in whole fruit sauce up to the point of adding the sugar. The thoroughly cooked fruit is run through a ricer or sieve to remove the skins. The pulps are returned to the fire and sugar in same ratio as given in whole fruit sauce is added. Cooking is continued in the open kettle until the pulps will give the jelly test, or to 216–217° F.

The finished sauce is filled while hot into clean dry jars, filling them full. They are then sealed and allowed to cool before storing.

Grapes

The canning of grapes to be used for sauce, pie filler, or for subsequent manufacture into juice, jelly or jam may be accomplished in

several ways. The most satisfactory method is as follows: The berries are removed from the clusters and washed. They are then packed into containers, using a spoon to press them down until sufficient juice is set free to practically cover the berries. Glass-top jars are partially sealed and processed in the water bath, pints 15 minutes, quarts 20 minutes.

Peaches

The fruit should be ripe—all soft, or stale fruit should be discarded. The soft ones will make good butter. Stale fruits are seldom if ever used profitably.

The fruits are peeled (see page 68), halved, and pitted. The halves are placed in a weak brine until ready for packing. The fruit is removed from the brine, rinsed well in cold water and packed " cups " down in clean, dry jars. The syrup should be hot and may vary from 30 to 50 per cent, depending upon acidity of the fruit. The jars are filled with the hot syrup, partially sealed and processed in the water bath 20 minutes for pints, 25 minutes for quarts. Jars are removed, sealed, and allowed to cool before storing.

Pears

Most varieties of pears are greatly improved if picked when fully grown and are allowed to ripen in storage. The fruit should be uniformly well ripened. Large pears are usually canned in halves, small varieties often are canned whole. If canned in halves, the fruit is peeled, cored, and placed in weak brine (one tablespoonful of salt per quart of water). The prepared fruit is then placed in a cheesecloth a few pounds at a time and blanched in a vessel of boiling water. The length of blanching will vary, depending upon the size of pieces and fruits 3 to 5 minutes. They are cooled at once in cold water and packed; halves, with cups down, as tightly as possible without crushing. The syrup may be 30 or 50 per cent, depending upon taste. The syrup is added hot, the jars are partially sealed, and are processed in the water bath 25 minutes for pints, 30 minutes for quarts. After processing jars are removed, sealed, and allowed to cool before storing.

Pineapple

When pineapple are in their full season they are low in price and the home canner may well take advantage of this to can a year's supply of this delicious fruit. Size 24 is more economical than smaller sizes.

The fruits are first trimmed, that is, the base and top are removed. The fruit is then set on its base on a cutting board and with a sharp knife a thin layer of peel is removed by cutting from top to bottom following the curve of the fruit. This slice should remove the outer fibrous coat to about one-half the depth of the eyes. The fruit is then laid on the side and is cut into thin disks, cutting across the core. These disks are trimmed to remove the remaining portion of the " eyes," the core is removed, and the finished slices cut into suitable sized pieces. The pieces are packed moderately tightly into clean glass jars. The jars are filled with 50 per cent syrup, then partially sealed and processed in the water bath, pints 45 minutes and quarts 55 minutes. After processing, the jars are removed, sealed, and allowed to cool before storing.

Plums

As a general rule plums are canned with their skins on. If the bitterish flavor and the astringency of some sorts are objectionable much of these qualities may be removed by skinning the fruits. Also some of the large blue and purple varieties and some of the Green Gage type are freestone and these may be halved and pitted in the same manner as peaches. The soft, juicy plums such as many of the Japanese and practically all the native varieties are unsuited for canning.

The fruits should be evenly ripened. If the skins are to removed it may be done by blanching just long enough to loosen the skins, $\frac{3}{4}$ to 1 minute. If the colored plums are skinned immediately the fruit will be greenish or yellow, depending upon the natural color of the flesh. But if allowed to stand for several minutes the color which lies within the inner part of the skin will flow into the flesh, making the fruit pink or red.

The fruits are packed as tightly as possible into clean, dry jars. The syrup should vary from 30 to 50 per cent, depending upon acidity of the fruit. The jars are filled with the hot syrup and all free air is excluded. The jars are then partially sealed and processed in the water bath, 20 minutes for pints and 25 minutes for quarts. After processing the jars are removed, sealed, and allowed to cool before storing.

Strawberries

No fruit loses so much of its natural flavor, taste, and color as does the strawberry and perhaps in no fruit is the question of variety so important. Strawberries may be roughly grouped into three classes: (1) Those varieties in which the core or central part of the berry is

white, (2) those in which the core is pink, and (3) those in which the core is dark red.

Those in group (1) blanch to a pale straw color by ordinary methods of canning; group (2) holds some of its natural color, but are as a rule very unattractive after a few months; those in group (3) as a rule retain a fair amount of their color and are quite attractive and of more than mediocre quality. Strawberries differ greatly in their acidity so that it is difficult to make recommendations regarding the amount of sugar to use or the percentage of syrup best suited to canning.

There are many ways of canning this fruit but only two will be described here. The berries first have their hulls or calyxes removed and are then thoroughly washed to remove all dirt and sand. They should not be allowed to stand long after washing because they soften rapidly if wet.

The berries may be packed into containers as tightly as possible without crushing them and covered with 30 to 50 per cent syrup. The jars are then partially sealed and are processed in the water bath, pints 12 minutes and quarts 15 minutes.

Strawberries canned in this way will shrink and float in the jar, leaving the lower third to half of jar full of syrup only while the shrunken berries are crowded into the upper portion of the jar. The heavier the syrup the greater the shrinkage of the fruit.

Strawberries may be canned in such manner as to secure a large part of the shrinkage before packing, thereby avoiding in a large measure the floating of the fruit in the jars. The berries are prepared as above. For each quart of fruit 3 to 5 ounces of sugar are allowed, depending upon the acidity. The berries and sugar are placed in alternate layers in a jar or kettle, enough sugar being reserved to cover the top layer thoroughly. The vessel is covered and set aside in a cool place for several hours, overnight if possible. After standing it will be found that the sugar has caused much juice to flow from the fruit and that most of the sugar is in solution in this juice. The fruit is stirred carefully and either gently heated to effect solution of remaining sugar or allowed to stand for a few hours longer. The fruit and syrup are filled into clean, dry jars, filling them full. They are then partially sealed and processed in the water bath, pints for 12 minutes and quarts 16 minutes. After processing the jars are removed, sealed, and allowed to cool before storing.

Raspberries

Of the three commonly grown species of raspberries the red and purple varieties are most commonly canned. The black varieties are very

seedy and for this reason are not popular as canned fruit. Cuthbert is the leading red variety. It is large, attractive, of good quality, and stands up well. Latham is a close second. Herbert is a large, juicy berry which breaks up too easily for a good canning fruit. Columbia is the most widely grown purple raspberry and is a popular canning berry.

Raspberries are as a rule canned for use as dessert. They should therefore be sweetened sufficiently for use. The berries should be fresh. They are washed, drained, and packed as tightly as possible without crushing. Syrup will vary from 30 to 50 per cent, depending upon taste. The jars are filled with hot syrup and all free air is excluded. The jars are partially sealed and processed in the water bath, 12 minutes for pints and 15 minutes for quarts. After processing the jars are removed, sealed, and allowed to cool before storing.

If desired for culinary or manufacturing purposes they may be canned in the same manner as blueberries (see page 71).

Rhubarb

Rhubarb may be canned in pieces or as a sauce. When young and tender the outer skin should not be removed.

The stalks are trimmed by cutting off the tough part at the base; also extreme outer tip. The stalks are laid on a cutting board and with a sharp knife they are cut into convenient lengths, about ½ inch. The pieces are then blanched in hot water just long enough to make the pieces flexible, ½ to 1 minute, and cooled at once in cold water. The pieces are packed tightly into clean, dry jars. Hot 50 per cent syrup is added, the jars are partially sealed, and processed in the water bath, 10 minutes for pints and 12 minutes for quarts. After processing the jars are removed, sealed, and allowed to cool before storing.

If the cut rhubarb is allowed to stand in twice its weight of water for 4 to 6 hours it will lose approximately 25 per cent of its acid without materially affecting the flavor.

Rhubarb Sauce.—The rhubarb prepared as for canning is placed in a saucepan and for each pound of material one-half cup of water is added. It is then cooked at slow boiling until the pieces are soft. One-half pound of sugar per pound of rhubarb is added and boiling is continued until sauce is of desired consistency. The hot sauce is filled into clean, dry jars, filling them full. The jars are immediately sealed and allowed to cool before storing.

TIME TABLE FOR BLANCHING AND PROCESSING FRUITS

The processing periods given here are for elevations of 1000 feet, or less. In more elevated sections the period must be lengthened.

TIME TABLE FOR BLANCHING AND PROCESSING FRUITS

Fruit	Time of Blanching	Time of Processing, in Water Bath, at 212° F.	
		Pints	Quarts
		Minutes	Minutes
Apples	8–10 at 180°–190° F.	12	16
Blueberries	20–30 seconds	15	20
Cherries	....	15	20
Cranberries	....	12	16
Grapes	....	15	18
Peaches	3–5 minutes	20	25
Pears	3–5 minutes	25	30
Pineapples	....	45	55
Plums	....	20	25
Strawberries	....	12	16
Raspberries	....	12	16
Rhubarb	....	12	16

NOTE.—For all practical purposes the No. 2 tin can is given the same processing as pint jars and No. 3 tin cans the same as quart jars.

SYRUP TABLE[1]

The following table gives the amount of sugar, in ounces, or the volume of water, in cups, required to change a quart of syrup of any per cent sugar content to a desired syrup of either a higher or lower sugar content.

The numbers in the horizontal column at the top of the table represent the per cent of sugar in the given syrup or the syrup whose sugar content is to be changed. The numbers in the vertical column at the left of the table represent the per cent of syrup desired. The numbers in the squares in the upper right-hand triangle forming one-half of the table represent cups of water necessary to add to a quart of given syrup in order to dilute it to the desired syrup. The numbers in the squares in the lower left-hand triangle of the table represent ounces of

[1] Originated and worked out by Carlton Cartwright, formerly instructor in Horticultural Manufactures, Massachusetts Agricultural College.

Cups of water to be added to 1 quart of a heavy syrup to reduce it to a desired lighter syrup

TABLE FOR CONVERTING A SYRUP OF KNOWN SUGAR TO SYRUP OF ANY DESIRED SUGAR CONTENT

Desired per cent syrup	Given per cent syrup														
0	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
5	1.76	......	4.15	8.47	12.97	17.66	22.54	27.63	32.94	38.48	44.27	50.30	56.61	63.19	70.05
10	3.71	1.89	......	2.12	4.32	6.62	9.02	11.51	14.12	16.83	19.67	22.64	25.73	28.96	32.33
15	5.89	4.00	2.04	......	1.44	2.94	4.51	6.14	7.84	9.62	11.48	13.41	15.44	17.55	19.76
20	8.35	6.37	4.33	2.21	......	1.10	2.25	3.45	4.71	6.01	7.38	8.80	10.29	11.85	13.47
25	11.12	9.06	6.93	4.71	2.41	......	0.90	1.84	2.82	3.85	4.92	6.04	7.21	8.42	9.70
30	14.30	12.14	9.90	7.58	5.16	2.63	......	0.77	1.57	2.40	3.28	4.15	5.15	6.13	7.18
35	17.97	15.42	13.33	10.88	8.33	5.67	2.90	......	0.67	1.37	2.11	2.88	3.68	4.51	5.39
40	22.25	19.53	17.33	14.73	12.03	9.21	6.27	3.20	......	0.60	1.23	1.89	2.57	3.29	4.04
45	27.30	24.71	22.05	19.28	16.40	13.40	10.26	6.99	3.57	......	0.54	1.12	1.71	2.34	3.00
50	33.38	30.58	27.72	24.75	21.65	18.42	15.05	11.53	7.85	4.02	......	0.50	1.03	1.58	2.16
55	40.80	37.75	34.65	31.43	28.07	24.56	20.90	17.08	13.09	8.92	4.56	......	0.45	0.96	1.47
60	50.06	46.71	43.31	39.77	36.08	32.23	28.21	24.02	19.64	15.05	10.26	5.25	......	0.44	0.90
65	62.00	58.24	54.45	50.51	46.39	42.10	37.62	32.94	28.05	22.93	17.59	12.00	6.14	......	0.41
70	77.88	73.61	69.30	64.81	60.13	55.25	50.15	44.83	39.27	33.45	27.36	21.00	14.32	7.33	......

Ounces of sugar to add to 1 quart of a given light syrup to make a desired heavier syrup.

sugar necessary to add to a quart of syrup to increase its sugar content to the desired syrup.

I. To Change a Light Syrup to a Heavy Syrup.—The per cent of the light syrup is found in the horizontal column at the top of the table. The vertical column directly below is followed down until it intersects the horizontal column opposite the desired per cent syrup that is found in the extreme left vertical column. The numbers at the intersection are in the lower left-hand triangle and therefore represent ounces of sugar necessary to add to one quart of the lighter syrup to raise the sugar content to the desired heavier syrup. For example, suppose a 20 per cent syrup is to be changed to a 50 per cent syrup. Following down the vertical column under 20 per cent to its intersection with the horizontal column opposite 50 per cent we find 15.05, the number of ounces of sugar required to change one quart of 20 per cent syrup to a 50 per cent syrup.

II. To Change a Heavy Syrup to a Light Syrup.—The per cent of the heavy syrup is found in the horizontal column at the top of the table. The vertical column directly below is followed down until it intersects the horizontal column opposite the desired per cent syrup found in the extreme left column. The numbers at the intersection indicate the cups of water to be added to each quart of heavy syrup to reduce it to the desired lighter syrup. Suppose a 50 per cent syrup is to be changed to a 30 per cent syrup. Following down the vertical column under 50 to its intersection with the horizontal column opposite 30 we find 3.28, which is the number of cups of water required to change a quart of 50 per cent syrup to a 30 per cent syrup.

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See Chapter III, Canning, for other references.

CHAPTER VIII

CANNING VEGETABLES

Only fresh properly matured vegetables should be canned. They should be free from decay and from injuries due to rough handling. The more perishable vegetables should be canned within a few hours after harvesting because they deteriorate rapidly. The less perishable ones such as beets, carrots, and winter squash may, if necessary, be held for some time. In fact winter squash and pumpkin will be greatly improved if allowed to ripen thoroughly in storage. Vegetables that are canned while immature, such as peas, string beans, sweet corn, and greens, should be used at that stage when they are just right for table use.

Grading.—Many of the vegetables, if canned in sufficient quantity to warrant it, should be graded according to size and degree of maturity. Grading is imperative if products are to be sold. Asparagus, beets, carrots, peas, string beans, and tomatoes will give much more satisfactory packs if properly graded.

Washing.—Most vegetables require thorough washing before preparation. Running water is preferable but if not available the vegetables should be washed through several changes of water. They should be lifted from the wash water rather than to pour the water off them. Beets and carrots may require thorough scrubbing.

Blanching.—Blanching is the operation in which the raw material is subjected to the action of steam or hot water for a specified time followed, as a rule, by thorough cooling in cold water. This partial cooking of the vegetable is for some definite purpose and when that is accomplished, further cooking is stopped at once by the transfer of the material to cold water. Some of the objects of blanching are still a question for investigation, but practical canners agree that most vegetables should be blanched. The reasons which are most commonly given for blanching are as follows:

1. To reduce the bulk, as in greens.

2. To remove objectionable flavors. All green-colored vegetables have a peculiar flavor which is volatilized when cooking takes place in an open vessel. This flavor remains in the container when the vegetable is cooked in a sealed or partially sealed container. Blanching will remove the excess of this objectionable flavor.

3. To expel included gases; all vegetables have some air or other gases enclosed within them. Some contain large amounts of included gases. When the vegetables are heated their tissues become more porous, the included gases expand and the bulk of them are forced out. If the cooling process which follows heating is prolonged until the vegetables are quite cold, water is absorbed to fill the space previously occupied by the gases in the unblanched vegetable. Many fresh vegetables float on water, but when well blanched and properly cooled they will sink in water.

4. To facilitate handling and packing. Such vegetables as asparagus, carrots, string beans, and others of similar character not only handle more satisfactorily if properly blanched, but also more material may be packed into the containers. Sweet corn that has been blanched is less " mussy " and packs much better than unblanched corn.

5. As an aid to preservation. Blanching destroys many of the active bacteria and washes away large numbers of spores in contact with most vegetables. The hot water or steam quickly softens the vegetable tissue and thereby permits more rapid penetration of heat during the early stages of processing.

6. For effect on color. The proper amount of heating followed by cooling in a weak brine may favorably affect the color of some green vegetables such as asparagus and green string beans. Blanching gives a finished appearance to some vegetables, notably carrots. As a rule there is less sediment in jars of properly blanched vegetables.

7. To remove skins. The most economical and practical method of removing the peel or skin from such vegetables as beets, carrots, and tomatoes is by blanching. The exposure to the heat of the water or steam cooks the vegetable just enough to loosen the skin and the sudden cooling in cold water stops any further cooking which would make the vegetable soft.

The Blanching Period.—Unless otherwise specified the blanching water should be boiling before the vegetables are placed in it and the volume of the water should be, at least, four to six times that of the material to be blanched. The blanching period begins when the materials are placed in the boiling water and proceeds for the length of time specified or until desired results are obtained. Obviously the relative amounts of water and material will have a profound effect upon the results accomplished in any given period. If the blanching periods given do not produce the desired results the necessary adjustments can be made. Results, not the blind following of a recipe, are what is desired.

Filling the Containers.—As a general rule the interval between blanching and packing should be brief. Blanched vegetables should be left in the cold water only long enough to become thoroughly chilled. They should be packed and processed with as little delay as possible.

Insufficient blanching may be the cause of slack packing of jars or it may cause a lack of free liquor in the jars. Over-blanching will result in soft, pulpy materials.

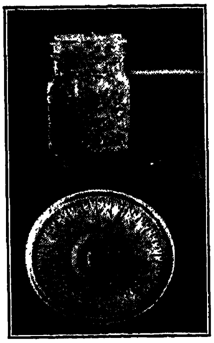

FIG. 26.—Most vegetables should be packed by weight, not by guess.

Packing.—In order to reduce spoilage to a minimum and at the same time to secure attractive packages the containers should be packed uniformly. The home canner and small factory operator are urged to pack by weight until they have become sufficiently expert to rely upon their experience as a guide. It is most unfortunate that the glass jars now available vary so much in their respective capacities that no standard weights can be given. (See page 55.) The following general rule may serve as a guide in establishing a standard pack for the different vegetables. As a general rule the minimum amount of material which will give a well-filled, moderately tight and attractive looking jar after processing is the most satisfactory pack.

CLASSES OF VEGETABLES

The experienced vegetable canner groups the common vegetables into four general classes: 1. Those that swell during processing, as peas, shell beans and succotash. 2. Those that tend to pack too tightly, as sweet corn, baked beans, and all greens. 3. Those that pack loosely or that leave large spaces in the container, as beets, carrots, corn on the cob, string beans, etc. 4. Those that are fairly liquid and that neither shrink nor swell as a result of processing, such as tomatoes, soup stocks, etc.

The careful canner will take the above facts into careful consideration and will pack accordingly. Vegetables in Class 1 will be packed lightly, allowing sufficient space for the increased volume which comes as a result of processing. A part of this increase in volume is due to absorption of liquid in the jar. This results in the jars having a rather low liquor content. This may be counteracted to some extent by leaving the vegetables in the cooling water an additional five or ten minutes and by filling the packed jars full of liquid instead of filling only to within one-half inch of the top.

Vegetables in Class 2 are the most difficult to pack unless a standard weight per jar has been worked out. Those like sweet corn and baked beans should be shaken lightly into the jar, filling the jar to within ½ inch of the top; and brine (in case of corn) or pot liquor (with baked beans) should be added filling container full. Greens when properly blanched may be packed into the jars until the liquid fills the jar and the solids are within ½ inch of the top. (See page 90.) Over-packing of these vegetables is sure to result in spoiled packages.

Vegetables in Class 3 are packed as tightly as possible without injury to the material, and the jars are filled full of liquid—water or brine.

Tomatoes and squash pulp if thoroughly cooked are packed into the jars filling them practically full.

Note.—In packing tin cans a head space of ⅛ to ¼ inch must be left in all cases.

Salt or Brine.—In canning vegetables in the home it is the general custom to add salt to the packed material and if additional liquid is necessary the jar is filled with hot water. When larger quantities are canned it is easier to add the salt in the form of brine except in those cases such as tomatoes and greens where no additional liquor is necessary. Brine for this purpose is made by dissolving four to six tablespoons of salt in a gallon of water.

Salt or brine is added to vegetables because it improves their flavor and because the solvent power of pure water destroys the firmness and color of many vegetables. Salt has a tendency to toughen the fibers and to fix or set the color. Water which contains any appreciable amount of iron or lime should not be used in canning. Iron will darken the color of the liquor of some vegetables and lime tends to toughen and harden many vegetables.

The canner should avoid the use of table salt which contains starch. The starch is insoluble and will give a cloudy appearance to the liquor or it may form a white deposit on the bottom of the jars.

PREPARATION OF CANNED VEGETABLES FOR THE TABLE

Dietitians are pretty well agreed that practically all non-acid vegetables should be given a few minutes' boiling in an open vessel before serving. Any package of vegetables that has a foreign odor or that in taste, flavor, or appearance is not normal should be discarded.

These precautions are recommended because they constitute the best possible insurance against any ill effects from eating spoiled canned vegetables (see page 4). Comparatively little injury has resulted

from the consumption of canned vegetables and most, if not all, of this could have been prevented had the proper precautions been observed. These suggestions should be applied to both home canned and factory canned vegetables. If canned vegetables are to be used in salads they may be heated sufficiently in advance to allow cooling before time of serving.

RECIPES FOR CANNING VEGETABLES

Asparagus

Asparagus should be young and tender and since it deteriorates rapidly it should be canned as soon after harvesting as possible. It should be graded to size and condition and thoroughly washed in cold water. The stalks are then cut to a length suitable for packing vertically in the containers. This is most readily done by means of a cutting box having two sides open and a depth that is the length of stalk desired. The graded stalks are laid in the box tips against the back and when a sufficient number to fill a container has been placed, the protruding butts are cut off with a sharp knife. The stalks are then tied into bundles or left loose, depending upon method of blanching. The purpose of blanching is to remove the excess chlorophyll flavor, expel contained gases and to make the stalks flexible for ease in packing. Blanching may be done in either of two ways: (1) The loosely tied bunches are set into the blanching bath tips up with the hot water coming up about half-way to the tops. They are left in this position for 3 to 5 minutes then the bunches are laid on the side so that the tips become submerged and are left for 2 to 3 minutes longer. They are then removed and quickly cooled in cold water. This method has the advantage of giving a uniform blanching but does require more time and attention. (2) The loose stalks are placed in a wire basket or cheesecloth and blanched in steam (10 to 15 minutes) or in boiling water for 3 to 4 minutes, depending upon age of asparagus. The stalks are then quickly cooled in cold water. Although this latter method requires less attention than the one preceding it does not give as uniform blanching, but results are fairly satisfactory if the blanching period is not too long.

The stalks are packed into the container, tips up, except in the center of the package two or three stalks should be packed tips down. This tends to even up the tightness of the pack and makes it easier to remove the perfect stalks from the container when opened for use.

One teaspoonful of salt is added to each pint jar and water is added to fill the container. Glass jars are partially sealed and processed in

the hot water bath at 212° F., pints 100 minutes, quarts 120 minutes; or under 10 pounds steam pressure, pints 35 minutes, quarts 40 minutes.

In cutting the asparagus into suitable lengths for canning as stalks or tips there is generally a part of the discarded butts that is tender and of good quality. This is canned as chunks or cut asparagus. The tender portion is cut into inch lengths, blanched in steam for 20 minutes or in boiling water for 5 minutes, cooled in cold water and shaken lightly into containers. A teaspoonful of salt is added to each pint jar and the jar is filled with hot water. The jars are partially sealed and processed as directed for canning stalks.

Asparagus from fields that have recently been limed or that have had sulfur dust applied for control of insects should not be used for canning.

Beans

Beans are canned for their pods (string beans), which are fleshy, tender and crisp, or for their seeds after they have become more matured. Some shell beans, as the navy or pea beans, are allowed to mature and are then canned as baked beans, as pork and beans, or beans with tomato sauce.

Commercial canners use four principal varieties: Refugee for pods, Lima, Red Kidney, and Navy or pea beans for seeds. The small canner might well add to this list some of the tender stringless wax beans, the young, tender Kentucky Wonder beans for pods and the more matured Kentucky Wonder and the horticultural types for seeds or as shell beans.

String Beans.—The pods should be young and tender and practically free from strings or woody fibers. They should be canned while fresh as they lose quality rapidly after picking. They are thoroughly washed, then snipped, that is, the stem end and blossom end are cut off with a knife. The pods may be left entire or cut into short lengths—about one inch. The prepared beans are then placed in a wire basket or cheesecloth bag and blanched in hot water for 3 to 5 minutes—depending upon the age of the beans. They are then cooled in cold water. They should be packed moderately tightly into the containers. A teaspoonful of salt is added to each pint jar and the jar is filled with hot water. Glass jars are partially sealed and processed in hot water bath at 212° F. pints 100 minutes, quarts 120 minutes; or under 10 pounds of steam pressure, pints 35 minutes; quarts 40 minutes.

Shell Beans.—In this class would be placed the pole beans, the horticultural varieties, the Red Kidney and the Limas. All these are handled in practically the same manner except the Limas which are

picked while the pods are still green and while only a small per cent of the seeds have become white. All others are picked when the pods have become somewhat ripened, that is, the pods are pliable and leathery but not dry. They shell easily and the seeds are large and plump, but still fairly soft and tender and of excellent quality. The beans should be hulled or shelled soon after picking. They are washed and blanched in boiling water for 3 to 5 minutes, then chilled in cold water. The blanching has shriveled the beans somewhat and therefore they should not be packed too tightly. They are shaken lightly into the containers filling to within ½ inch of the top. A teaspoonful of salt is added to each pint and hot water is added to fill the jar. Glass jars are partially sealed and processed in hot water bath at 212° F., pints 160 minutes, quarts 180 minutes; or under 10 pounds steam, pints 50 minutes, quarts 60 minutes.

A small chunk or slice of pork or of good lean bacon will add to the attractiveness of any of the shell beans except possibly the Limas.

Baked Beans.—Beans are baked the same as for table use except that the cooking may be stopped before the beans are quite done, and the liquor should be in greater abundance. The baking should not proceed until the beans become broken. They are filled into the containers, making only a moderately close pack. Enough of the hot liquor is added to fill the spaces and cover the beans, and the container is filled to the top. If there is not enough pot liquor then hot water must be substituted. Glass jars are partially sealed and processed in hot water bath at 212° F., pints 100 minutes, quarts 120 minutes; or under 10 pounds steam pressure, pints 35 minutes, quarts 40 minutes.

Tomato sauce may be added if desired.

Beets

The dark red beets are best for canning. The tops should be cut off about 1 inch above the beet to avoid excess loss of color during the blanching period. Beets for canning should be small, varying from 1 inch to 2 inches in diameter. The medium or smaller sizes are most desirable; above 2 inches they should be canned in slices or chunks.

The beets are first thoroughly washed and then boiled or steamed until the skin slips easily. They are then cooled in cold water. The top and root are cut off and the skins removed. If the blanching has been thoroughly done the beets may be easily squeezed out of their skins. The beets are graded and packed as tightly as practicable into the containers. A teaspoonful of salt is added to each pint jar and the jar is then filled with hot water. Glass jars are partially sealed and

processed in water bath at 212° F., pints 90 minutes and quarts 100 minutes; or under 10 pounds steam pressure, pints 35 minutes, quarts 40 minutes.

Carrots

The small carrots which are often thinned out of the rows, also the small ones at harvest time, "the fingerlings," are generally wasted. These are delicious when canned. Also if storage facilities are lacking the larger carrots may be canned for use in the winter diet. The younger carrots are usually canned whole. They may be given only a thorough washing preparatory to packing or they may be blanched for a few minutes to facilitate packing and to improve their appearance. The larger carrots are usually split lengthwise or cut into thin transverse slices. Before cutting into slices the larger carrots are scraped to remove the tough skin or they may be blanched in hot water long enough to cause the skin to slip easily. If the skin is scraped off the sliced carrot should be blanched 3 to 5 minutes to facilitate packing and to improve the appearance. The prepared carrots are packed tightly into clean, dry jars. A teaspoonful of salt is added to each pint jar and the jar is filled with hot water. The jars are partially sealed and processed in the water bath at 212° F., pints 80 minutes, quarts 90 minutes; or under 10 pounds steam pressure, pints 30 minutes, quarts 35 minutes.

Cauliflower

The heads are separated into small pieces and placed in a weak brine (4 tablespoonfuls salt per gallon of water) for several minutes. The material is then blanched for 3 to 5 minutes in boiling water and cooled at once in cold water. The pieces are packed tightly into clean, dry containers. One teaspoonful of salt is added to each pint jar and it is filled with hot water. Glass jars are partially sealed and processed in water bath at 212° F., pints 100 minutes, quarts 120 minutes; or under 10 pounds steam pressure, pints 35 minutes, quarts 40 minutes.

Corn

Commercial concerns can corn principally in two styles. In one of these, which was practiced first in Maine, the tips of the kernels are cut off and the milky pulp is scraped from what remains on the cob. These tips of kernels together with the scraped corn are mixed with the sweetened brine forming a thick creamy product. Corn canned in this style is known as cream corn or Maine style. In the second method

the whole kernels are cut from the cob and mixed with a weak brine. This is known as Maryland style.

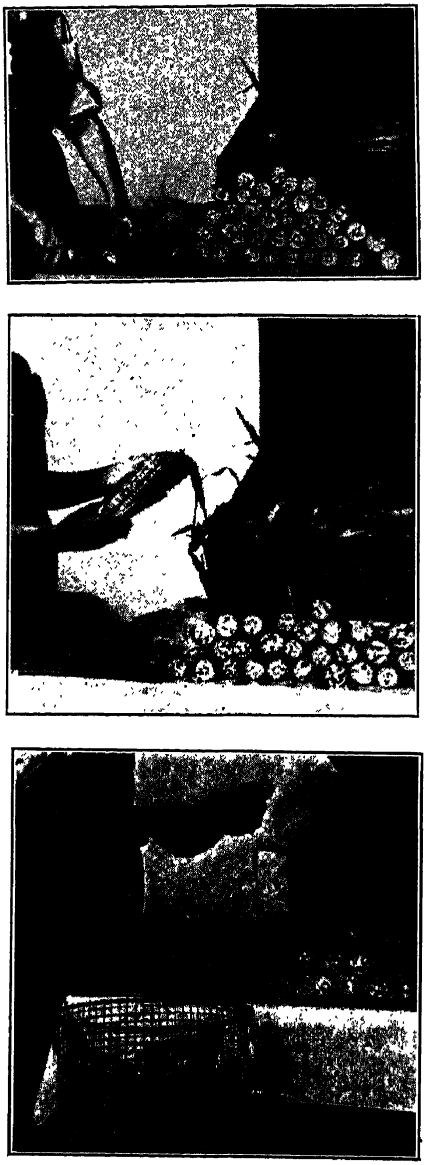

Fig. 27.—Preparing sweet corn for canning.

Top, cutting through the husks at the butt of the ear. Center, stripping off the husks. Bottom, brushing off the silks.

The home or farm factory canner may follow either of these two methods. As a general practice, however, where corn is canned in small quantities, it is put up in the home style of which there are two general methods. First: the corn is cut or scraped from the cob, packed into containers and the usual amount of salt is added. No liquid is used. The corn is said to be packed in its own milk. Second: the corn is given a short preliminary cooking (blanched) and is then cut from the cob in thin slices and scraped only to secure the very tips of the kernels.

Each of these two methods of home style packing of sweet corn has its good and its bad points. The second method however is preferable because the finished product makes a much better appearance in the glass container; the food value must rank higher since more of the coats of the kernels are included; there is less bother in cutting and packing the blanched corn; there is not as strong a tendency to overpack the containers, and finally the danger from souring before processing begins is reduced to a minimum.

Corn for canning should not be too young because at that stage its food value is low and the quality and flavor have not fully developed. Nor should it be too old as it will be tough and of low quality. It is at its best when in the latter part of the milk stage, and may be handled

successfully up to the heavy dough stage—the stage in which the milk becomes doughlike or cheeselike. It is most nutritious and of highest quality during the last few days of the milk period.

Corn should not be picked long before it is canned since it deteriorates rapidly. The husks may be most easily and quickly removed if the shank of the ear is cut through just grazing the bottom kernels. This frees the husks at the butt of the ear and with two or three quick movements they may be separated at the point of the ear and quickly removed together with the larger part of the silk. The complete removal of the silk is most easily accomplished by means of a stiff fiber or bristle brush.

The corn is next submerged in boiling water for 5 to 6 minutes. It is then cooled quickly in cold water and is ready for cutting. The corn should be cut in thin, even slices making two or three cuts to remove the greater part of the kernels. The extreme inner tips should be scraped out to avoid excess of chaff. The knife must be sharp and the stroke or cut should be from tip to butt of ear.

The cut corn is shaken somewhat loosely into the containers, which are filled to within ½ inch of the top. A teaspoonful of salt is added to each pint jar. Hot water is then poured in to fill the jar. The corn is stirred in the container with a spatula or knife to insure escape of all air bubbles. If necessary more water is added to fill the jar.

Another method of packing which will insure a uniform amount of corn in each jar is as follows: The cut corn is weighed and placed in a kettle. One cup of water and one teaspoonful of salt are added for each pound of corn. The kettle is set over the fire and is heated, with occasional stirring, to the boiling point. The hot corn is filled into the container to within ¼ inch of the top. Tin cans are sealed while hot. Glass jars are partially sealed and processed in water bath at 212° F., pints, 3 to 4 hours; or under 10 pounds steam pressure, pints 70 minutes.

Corn on Cob.—Corn may be canned on the cob. Though not economical from the standpoint of containers required it will give a very satisfactory diversion from the ordinary canned corn.

Medium-sized ears should be chosen. If Golden Bantam or other variety of similar type is used, about 8 to 10 ears may be packed in a two-quart glass jar. Quart jars will hold about 4 to 5 ears.

The corn is prepared as for the general type of canning except that it is not cut from the cob. The ears are packed as tightly as possible into the containers. A teaspoonful of salt is added to each quart jar and the jar is then filled with hot water.

Glass jars are partially sealed and processed in water bath at 212° F.,

quart jars $3\frac{1}{2}$ to 4 hours, two-quart jars $4\frac{1}{2}$ hours; or under 10 pounds steam pressure, quart jars 70 minutes, two-quart jars 80 minutes.

Greens

Many leafy plants both wild and cultivated are used for greens. Among the more important ones are chard, beet tops, dandelions, and spinach. All greens should be gathered while young and tender. They should be canned while fresh. The greens are carefully looked over and all undesirable parts are discarded. Thorough washing through several changes of water is necessary to remove all soil and sand. The washed greens are then blanched in steam for 20 minutes or in boiling water for 4 minutes. After cooling in cold water they are packed into the containers. They may be left whole or cut into short lengths. In either event great care must be exercised to prevent over-packing. The pack should be only moderately tight. When greens are closely packed the processing becomes a very uncertain thing and generally the percentage of spoiled packages run high. As a means of facilitating processing the following plan is used. Approximately 2 pounds of fresh prepared greens may be packed into a pint jar. After packing the greens are cut across from top to bottom of container leaving a thin space through which a reasonably free circulation of liquid may take place during processing. This hastens the time of raising the center of the container to the temperature of the processer and thereby reduces the probabilities of spoilage. After packing and cutting the greens, a teaspoonful of salt is added to each pint jar. Glass jars are partially sealed and processed in hot water bath at 212° F., pints 120 minutes; or under 10 pounds steam pressure, pints 50 minutes.

One of the most attractive of all the greens results when the tender beets not greater than $\frac{1}{2}$ inch in diameter are left attached to the tops. Such greens may be obtained in abundance by sowing the beets quite thick and thinning them when of the proper size. The beets are so young and tender that they require no special preparation other than a thorough washing. The entire plant is blanched as in canning any green.

Hominy or Hulled Corn

Hominy or hulled corn may be made from sweet corn or from the common field corn, either the flint or dent type.

The corn is shelled and placed in a porcelain or iron kettle. To each pint of corn two quarts of water and two rounded teaspoonfuls of concentrated lye are added. The corn is boiled slowly for 20 to 30

minutes, and stirred frequently during the latter part of cooking. It is then removed from the fire and allowed to stand for 15 or 20 minutes. Next it is thoroughly washed to remove the excess of lye, after which it is either rubbed vigorously through the hands or placed in a churn with water and thoroughly churned for several minutes. The churning or rubbing is necessary to remove the black tips and the softened hulls.

When the black tips have been separated from the corn by floating them on the wash water or by placing the corn in a coarse sieve and washing thoroughly, the hominy material is allowed to stand for several hours, during which time the water is changed frequently, or it may be thrash-cooked, that is, covered with water and brought to a boil for a few minutes, after which the water is drained off and fresh water is added and this is repeated until all excess lye has been removed. After the excess lye has been removed the hominy is cooked in water until tender. If the hominy is placed in a fine-mesh wire basket and set in a vessel of water no stirring is necessary. If no basket is available, frequent stirring must be given.

When the hominy has become tender it is packed and processed in the same manner as shell beans (page 86).

PEAS

Peas are one of the most difficult vegetables to can successfully. There are perhaps many causes for this. Those most likely to occur with home canners are over-packing, under-processing and packing without grading. Peas as they usually come from the garden contain pods in practically all stages of development. When the peas are shelled many of them are quite matured. In any given variety of peas the size is an index to the age. This fact may be utilized by the small canner to grade the peas into sizes which shall correspond to their ages. Cellar window wire has a square mesh and may be bought with several sizes of opening. If screens are made from ⅛-inch and ⅜-inch mesh the canner may grade the peas into at least three sizes by sifting them through these screens.

Peas should be canned as soon after harvesting as possible. They are first washed to remove any soil that may be on them, then they are shelled. The shelled peas are washed and graded. They are blanched for 3 to 10 minutes, depending upon the age of the peas. They should be blanched until the coats wrinkle but not long enough to cause them to burst. After blanching they are cooled in cold water, then packed lightly into containers. Since peas will swell somewhat they should not be packed very tight. A teaspoonful of salt is added

to each pint and hot water is used to fill the jar. Glass jars are then partially sealed and processed in water bath at 212° F., pints 3 to 4 hours; or under 10 pounds steam pressure, pints 45 minutes. The processing periods given are for medium-matured peas. Increase the time about 10 per cent for larger and older peas and shorten it 10 per cent for the smaller and tenderer peas.

Sweet Peppers

The ripe sweet pepper is much prized by many housewives for garnishing salads and for flavoring. These peppers are very easily canned and the farm factory will find a good market for them if packed in small containers. The half-pint or quarter-pint jar makes a suitable-sized package.

If to be used for garnishing the peppers should not be picked until well ripened. If for flavoring they are canned either green or ripe as desired.

Two general methods are practiced: (1) The ripe peppers are washed, then blanched in boiling water long enough to loosen the skin, and then cooled. Or the washed peppers are placed in the oven and baked or roasted long enough to loosen the skins. The core, seeds, and skin are removed and the peppers are either cut into strips or may be packed whole.

(2) The peppers are washed. The base carrying the stem is cut out and the seeds and white core are removed. The peppers are split along one side, laid on a cutting board and cut transversely into narrow strips $\frac{1}{4}$ inch or less. These strips are blanched for 5 minutes, cooled in cold water and packed loosely into small jars. Salt at the rate of $\frac{1}{4}$ teaspoonful to each half-pint is added and the jars are filled with hot water. The jars are partially sealed and processed in the water bath at 212° F., half-pints 70 minutes, pints 90 minutes; or under 10 pounds steam pressure, half-pints 30 minutes, pints 35 minutes.

Pumpkin

Pumpkin is most economically canned in the form of pulp. The pumpkins are washed and cut into halves, cutting from stem to blossom side. The seeds and their coarse adhering fibers are scooped out with a large spoon. The halves are then set in a steamer cup side up and steamed until tender throughout. A deep kettle with a wire rack on the bottom and a fairly tight cover makes an excellent steamer for this work. When somewhat cooled the pulp is removed with a spoon, mixed with water to the consistency of a pie filling and is then packed

into the containers which are filled to within $\frac{1}{4}$ inch of the top. A half-teaspoonful of salt is added to each pint jar. Glass jars are partially sealed and processed in hot water bath at 212° F., pints 100 minutes, quarts 120 minutes; or under 10 pounds steam pressure, pints 40 minutes, quarts 45 minutes.

The pumpkin may be cut into thin slices, peeled and these slices cut into small pieces. The pieces are blanched just long enough to make flexible but not soft (2 to 3 minutes). The pieces are packed tightly into clean jars. A half-teaspoonful of salt is added to each pint and the jars are filled with hot water. The jars are partially sealed and processed as given above. Or the peeled pumpkin may be cooked in a small amount of water until reduced to a fine pulp of desired consistency after which it is packed and processed the same as steamed pumpkin.

Succotash

This exceedingly delicious food was given to the English settlers by the American Indians. It was the custom of the early Indians to cook together, as a stew, green corn and beans either shelled or in the pod, and today this is one of the standard articles of diet.

The corn and beans may be mixed in almost any proportion although about half and half of each gives a very acceptable combination. The beans are usually of the shell bean type, limas, horticultural or pole beans being most commonly used.

The corn and beans are each prepared as for canning, then mixed in the desired proportion and packed into containers in the same way as in packing shell beans or corn. The processing is the same as for corn.

Tomatoes

Tomatoes should be well ripened on the vines. They should be handled carefully and they must be absolutely free from rot. They should be graded for color and to some extent for size. Tomatoes that have considerable green around the stem should be avoided, but if one must can them, all the green parts should be cut away.

Tomatoes are first thoroughly washed to remove all soil. They are then blanched in boiling water for about one minute or just long enough to cause their skins to slip easily. As soon as blanched they are cooled in cold water and are then ready for peeling and coring. Over-blanching will make the tomatoes soft and under-blanching will cause waste of time removing their skins.

The cores should be removed first. This is done with a short-bladed sharp-pointed knife. By inserting the knife into the base of the

tomato near the stem and to about the center of the fruit, and cutting around the stem, keeping a half-inch or more from it, a cone-shaped portion is quickly removed. This is mostly solid material and is not desired in the canned product. A few trials soon enable one to judge as to the size of cut necessary to remove the entire core.

The skins are then stripped off. This is most easily done by beginning at the blossom end. Often there is a small black spot at the blossom end which should be cut out. When a sufficient quantity of peeled tomatoes has been secured they are packed into the containers. If too large to pass readily through the opening they are cut into suitable size and are then packed closely enough to set free sufficient juice to fill all spaces between pieces and to cover the solids.

It is a violation of the pure food law to add water or the juice from other tomatoes. This law applies to all tomatoes canned for market.

Glass jars should be packed full. A half-teaspoonful of salt is added to each pint jar. Glass jars are partially sealed and processed in the hot water bath at 212° F., pints 30 minutes, quarts 35 minutes.

Squash

The same methods as for canning pumpkin.

Vegetable Mixture

Combinations of fresh vegetables may be canned together giving a salad mixture or mixed vegetables with the opening of but one jar. A suggested grouping which has met with much approval is a mixture of carrots, string beans, and peas. Certain other combinations are equally good. Each vegetable is prepared as for canning separately. The jar may be packed by filling it one-third full of peas well shaken down, next a layer of carrots, to make the jar two-thirds full, and finally completing the packing with the string beans. A half-teaspoonful of salt is added to each pint and the jars are filled with hot water, sealed, and processed. The processing period for any non-acid vegetable mixture should be that of the one in the mixture requiring longest processing. For example, in the above mixture, peas require the long processing, therefore the processing period for vegetable mixture would be that given for peas.

TIME TABLE FOR BLANCHING AND PROCESSING VEGETABLES

The processing periods given here for water bath are for sections having an altitude of less than 1000 feet. In areas where the elevation

exceeds this the use of the water bath for canning most vegetables is questionable. The periods given are in minutes.

TIME TABLE FOR BLANCHING AND PROCESSING VEGETABLES

Vegetable	Blanching Period, Minutes	Processing			
		Water Bath,		Steam Pressure 10 Pounds,	
		Pints, Minutes	Quarts, Minutes	Pints, Minutes	Quarts, Minutes
Asparagus	6–8	100	120	35	40
Beans—string	3–5	100	120	35	40
Beans—baked	....	100	120	35	40
Beans—shell	3–5	160	180	50	60
Beets	5–20	90	100	35	40
Carrots	3–10	90	100	35	40
Cauliflower	3–5	100	120	35	40
Corn	5–8	3–4 hrs.	....	65	
Greens	4–6	120	....	50	
Hominy	....	160	180	50	60
Peas	3–8	3–4 hrs.	....	45	
Peppers	4–6	80	....	30	
Pumpkin	2–3	120	140	40	45
Succotash	3–8	3–4 hrs.	....	65	
Squash	Until Soft	120	140	40	45
Tomatoes	1–1½	30	40	15	20

NOTE.—No. 2 tin cans are processed same as pint jars; No. 3 tin cans same as quart jars.

In those sections where Bacillus Botulinus is known to be prevalent the use of the water bath for processing non-acid foods should be discontinued in the interest of safety. Under such conditons all processing of non-acid foods should be done under steam pressure.

REFERENCES

See Chapters III, and VII.

CHAPTER IX

CANNING MEATS AND POULTRY

All canners recognize the fact that meats are the most difficult of all foods to can. Consequently, greater care must be given in order to produce good wholesome products. The least foreign odor or other indication of decomposition should condemn a piece of meat as possible canning material. It is extremely doubtful if it is ever wise to can cold-storage meats. If the meat is fresh its canning is a less complicated and dangerous problem.

Processing.—The processing temperature for meats of all kinds including poultry and sea foods is 240 to 250° F., under steam pressure of 10 to 15 pounds. There are, however, many home canners who are very successful in canning meats and poultry in the hot water bath where a temperature of only 212° F. can be secured. This is possible only when most careful attention is given to every detail of the operation and where a relatively long cooking period is given. When the water bath is used a processing period of not less than 3½ or 4 hours is recommended. Since steam pressure cookers are now readily available at moderate cost it is highly desirable that these shall be used in the canning of meats, poultry, and sea foods.

Precooking.—As a general rule all meats and poultry should be given preliminary cooking before packing into the jars. This is for the two-fold purpose of shrinking the meat and rendering adequate processing more nearly certain. In computing the number of containers required an allowance of 25 to 30 per cent must be made for shrinkage. This is exclusive of bones, excess fat, connective tissue and tendons which must be discarded.

Packing.—The jars should not be packed too tightly nor over-full. If the precooking has been sufficient there will be practically no shrinkage during processing. The meat should be cut into pieces of such size and shape as will pack most economically the size and style of jar being used, leaving some space for a small amount of liquid which is necessary to insure proper processing.

Preparation for the Table.—All meat canned in the home should be heated to the boiling point for a few minutes before serving. If to be served cold or in a salad it should be heated and allowed to cool.

ROAST MEAT—BEEF AND PORK

The meat is cut into pieces about one-third larger than desired for packing. It is placed in a roasting pan with 1 cup water for each 10 pounds of meat, with salt 1½ ounces per 10 pounds, to flavor. The pan is placed in a hot oven for 30 to 40 minutes, and turned and basted at the end of half the cooking period.

The hot meat is packed into clean, dry jars, moderately tight and to within ½ inch of the top. The jar is filled with the pan liquor or with a thin gravy made from the pan liquor and flour. The jars are partially sealed and processed under 15 pounds pressure or 250° F., pint jars for 50 minutes. When the pressure falls to zero the cooker is opened, the jars are removed and sealed.

POT ROAST—BEEF OR PORK

The meat is cut into pieces one-third larger than desired for packing. All cartilage, bone and excess connective tissue is discarded. The pieces of prepared meat are placed in a hot skillet or spider and quickly seared on all sides. Frequent turning is necessary to prevent burning.

The seared but rare-done meat is packed while hot into clean, dry jars. The jars are filled with a thin gravy made by heating water in the skillet in which the meat was cooked. A teaspoonful of salt is added to each pint jar. The jars are partially sealed and processed under 15 pounds pressure or 250° F., pint jars, for 50 minutes. When the pressure falls to zero the cooker is opened, the jars are removed and sealed.

BOILED MEAT—BEEF OR PORK

The meat is cut into pieces about one-third larger than desired for packing. If to be cooked in the open kettle, a rack is placed in the bottom of the kettle and the prepared meat is laid on the rack. Water is added to cover the rack and salt sufficient to flavor. The vessel is covered and the meat is boiled moderately from 1 to 1½ hours. If cooking is done in a pressure cooker water is added to cover the rack, the meat is placed on the rack, salt sufficient for flavoring is added and the vessel is covered. When the steam escapes freely from the pet-cock it is closed and the pressure is brought up to 15 pounds and that pressure is maintained for 20 to 30 minutes. After cooking the pet-cock is opened about half-way to permit quick cooling.

The hot meat is packed into clean, dry jars, which are then filled with the pot liquor, partially sealed and processed. Pint jars under

15 pounds pressure or 250° F. for 50 minutes. When the pressure falls to zero the cooker is opened, the jars removed and sealed.

POULTRY

Poultry, although not technically classed with meats, is fully as difficult to can. The home canner, however, has one distinct advantage if the poultry is grown on the farm, in being able to kill only as much as can be handled while fresh. There is therefore no excuse for canning poultry that is not strictly fresh killed. All poultry should be drawn as soon after picking as possible. The same care should be given to cleaning and scraping or brushing the skin as when preparing for the table. The canning operations should begin before there is opportunity for spoiling. Flesh of all animals is very perishable and decomposition begins soon after killing under ordinary temperature conditions.

Poultry, like meats, should undergo a preliminary cooking for the same reasons as stated in the discussion of meats. The boiling is more economically done in a steam pressure cooker than in the open kettle. Those who can foods, especially vegetables, meats and poultry, must remember that the long processing periods are not primarily for the purpose of making the products palatable, since this might be accomplished in much less time. But the long processing period of foods in the container is to insure their keeping, and although processing periods may be made too long it is always better to err on the side of too long rather than on too short processing.

The instructions given are for canning chicken but they may be applied to the canning of other kinds of poultry.

There are two common methods of canning chicken. When young they are broiled or fried and canned with the bones. When matured they are roasted or boiled and the bones are removed, the meat only is canned.

Fried Chicken

Young chickens weighing 2 to 3 pounds are best adapted to this type of canning. As a rule the chickens are cut into the usual number of pieces (eleven) and fried in fat as for table use but cooked only until the meat is about two-thirds done. The bony pieces such as the back and neck may be omitted from the pack, the meat from these being used for soup stock.

The hot meat is packed into clean, dry jars, which are then filled with a thin gravy made by browning some flour in the fat in the frying pan and thinning to the desired consistency, and 1 teaspoonful of salt

is added to each pint jar. The jars are partially sealed and processed under 15 pounds steam pressure or 250° F. for 60 minutes. When the pressure falls to zero the cooker is opened, and jars are removed and sealed.

Boneless Chicken

As a rule only matured fowls are canned in this way. This method gives a compact jar of meat with a minimum amount of liquid. The liquid material added at time of canning generally forms a jelly if proper care has been given.

The fowls are killed, picked, drawn, and cooled. The feet and outer joint of wing are discarded and the fowl is cooked whole. Cooking may be in open kettle with water to prevent burning or in the steam pressure cooker or in the steamer. The cooking should proceed to the point where the meat may be easily removed from the bones. In the steam pressure cooker this will require 30 to 40 minutes under 15 pounds pressure for 4- to 5-pound fowl. When the chicken has cooled sufficient to handle, it is placed on a large platter for cutting. The skin is removed and the fowl is cut into the regular number of pieces. The bones are then carefully removed leaving the larger pieces such as legs, thigh, and first joint of wings intact. The breast may be sliced or preferably the large muscles are separated into their individual parts. The smaller pieces of meat are picked or scraped from the back, ribs, and neck and kept separate from the remainder. Also the white and dark meat are placed in separate lots. The bones and skin are reserved for soup stock.

The prepared meat is packed into clean, dry pint or half-pint jars. The outer layer should be made up of part light and part dark meat. The center may be packed with the small pieces. The jar may be practically full but should not be so tightly packed as to leave no room for liquid. A half-teaspoonful of salt is added to each pint jar and hot broth from the cooking vessel is added to fill the jar to within $\frac{1}{2}$ inch of the top. The jars are partially sealed and are processed under 10 pounds pressure or 240° F., pint jars for 90 minutes. When the pressure falls to zero the cooker is opened, the jars are removed and sealed.

Soup Stock

Soup stock or bouillon—a by-product of canning chicken—is derived from two sources: (1) the excess of pot liquor nearly always found, that is, the liquid or broth in the vessel in which the preliminary cooking is made; and (2) the skin and bones left from canning boneless chicken.

The giblets may be included in this second source or they may be canned separately. If used for soup stock, they should be cut into several pieces.

The soup stock may be extracted from the skin and bones by cooking in either covered kettle or preferably in steam pressure cooker. If the covered kettle is used the water must be sufficient to cover the material to the depth of one or two inches. The cooking is at slow boiling for $1\frac{1}{2}$ to 2 hours. If the steam pressure cooker is used the material is pressed down and water is added at the rate of 3 cups for refuse from a 4-pound chicken. Cooking is at 15 pounds pressure for 1 hour.

The clear broth is strained from the bones and skin, through several layers of good cheesecloth. At this time the excess pot liquor may be added. The fat will rise to the surface and the excess may be removed by skimming and that remaining by straining a few times through several layers of cheesecloth; or the broth may be set in a cool place and after several hours the fat will solidify and may easily be removed.

It is highly desirable to have a proper and somewhat uniform concentration of this soup stock. Experience is of course the best guide but so many lack the necessary experience that it becomes necessary to set up some arbitrary standard. This is rather a difficult matter because so many factors must be taken into account. However, the experiences of some of our most successful canners indicate that the refuse from a 4-pound chicken should give 1 quart of soup stock of good consistency. The soup stock then obtained from a medium size fowl (4 to 5 pounds) should be concentrated by rapid boiling to 1 quart hot measure. Or if the bones have been cooked in an open kettle it may be necessary to make up the amount obtained to 1 quart by adding water. The bouillon may be canned plain, or a more attractive and more valuable product may be made if one or two tablespoonfuls each of rice and small pieces of chicken meat are placed in each jar. A teaspoonful of salt is added and the jar is filled with the broth or bouillon. The jars are partially sealed and are processed, pint jars, under 10 pounds of steam pressure, temperature 240° F., for 1 hour.

REFERENCES

See Chapters III, VII and XXII.

CHAPTER X

FRUIT PRODUCTS

The successful manufacture of fruit products imposes certain requirements upon the operator: (1) Ability to recognize and appreciate high-grade foods, and (2) a reasonably intimate knowledge of those factors which determine the grade of the finished product. With these requirements satisfied the operator may attack his problems intelligently with the hope of a satisfactory solution. Without this knowledge he must work on the "cut and fit" method, which is far less successful than is the rational application of rules and principles that will insure uniformity in grade of products manufactured.

STANDARDS AND GRADES

Uniform products are possible only through standardization. One of the first duties of the operator, therefore, is to establish a standard for the products he proposes to manufacture. The standard for any given food consists of the requirements prescribed for its manufacture. These requirements may be legal or arbitrary, provided that the latter do not violate the maximum-minimum standards set up by the Pure Foods Law (Appendix B). The operator must have standards not only relative to the conditions of raw materials and ratios of each that enter into the manufacture of his products, but also in methods of procedure.

The grade of a fruit product is the result of compliance with the standard requirements plus the art of the operator. The characteristics which determine the grade of a fruit product are *quality* and *appearance*.

Quality.—The quality of a fruit product is determined by the effects which its combined characters have upon certain of the sense organs. The principal characters involved are taste, flavor, aroma, consistency, and texture. The degree of pleasure or displeasure which any food gives the consumer determines its quality-rating insofar as he is competent to judge. Foods are said to possess high, medium, or low quality according to the manner in which they affect the consumer.

Since the individual is the judge of many of these elements there can be no absolute quality standard except as we rely upon the consensus of judgments of a relatively large group of consumers. And that, as a matter of fact, is what we do.

Appearance.—Appearance is an important factor in determining both the sale and consumption of fruit products. The appearance of a food is generally an index to the manner in which it has been manufactured and the kind of materials used, and indicates in no small way the quality. If the food is clean and attractive in appearance we are tempted to try one serving or to purchase one package. To many consumers, appearance is as important as taste or flavor.

FACTORS WHICH DETERMINE THE GRADE

The most important factors that enter into the manufacture of fruit products and which combine to determine their grade are:

A. The fruit
B. The cooking
C. The sugar
  (*a*) Amount or ratio
  (*b*) Time of adding
D. Economy in production
E. Equipment
F. Operator

A. The Fruit.—The character and condition of the fruit is of first importance. "One does not make a silk purse from a sow's ear," nor can fruit products of high quality be made from fruits which are deficient in that character. This does not necessarily mean that the fruit must be of highest market grade as regards size, shape, color, and freedom from blemishes, but that for most products the fruit may be, and generally should be, for economic reasons, those fruits which are well matured but which because of size, color, and blemishes would not find a ready market as fresh fruit. Exception to this general rule would need to be made for canning and preserves, both of which demand a good market grade of fruit.

Fruits come into the kitchen or factory in some one of the following conditions: (1) unripe or rare-ripe, (2) ripe, (3) over-ripe or soft, (4) stale. Often the operator is responsible for the condition of his fruit. Sometimes conditions beyond his control are determining factors. If the highest quality products are desired the operator should know the condition of fruit best suited to produce this result and then insist upon having fruit at the time it is in perfect condition for the purpose intended.

1. *Unripe Fruit.*—Fruit in this stage is characterized by high acidity, low sugar content, lack of natural fruit flavor and aroma, very firm texture and the presence of appreciable amount of starch. The more unripe the fruit the more pronounced are the above characteristics. Such fruits are more expensive to manufacture because of excess acid and lack of sugar. Their products cannot possess the aroma and flavor commonly associated with the well-ripened fruit.

The following table illustrates the relative acid and sugar content of unripened and well ripened fruits:[1]

Fruit	Condition	Sugar (Per cent)	Acid (Per cent)
Concord grape	Nearly all colored	8.60	1.91
Concord grape	Fully ripe	15.92	.95
Delaware grape	60 per cent ripe	13.08	1.92
Delaware grape	Fully ripe	25.78	.69
Baldwin apple	September 13	10.51	....
Baldwin apple	November 15	14.51	.65
Baldwin apple	December 15	14.07	.48

Unripe fruits of some kinds if not too green may be utilized in making pickles. The flavor and aroma are not so important here because they are largely obscured by the pickle solution. Also the juice of some unripe fruits, especially apples, may be used as an extender with other fruit juices or it may be used as a modifier, giving to a particular fruit juice some character which it does not possess, such as acid or pectin (see page 151).

2. *Ripe Fruit.*—Ripe fruits are designated as hard-ripe and soft- or mellow-ripe. Such fruits have developed their normal amounts of color, sugars, acids, and essential oils as well as the proper texture, and because of this they have their characteristic taste, aroma, and flavor. At the same time practically all of them that are normally used for jelly making will have sufficient pectin for that purpose. The hard-ripe fruits are preferred for such products as canned fruits, preserves, jellies, marmalades, pickles, and cider.

The soft-ripe fruits are generally preferred for butters, jams, juices, syrups, and conserves.

3. *Over-Ripe or Soft Fruits.*—These fruits if not too far advanced possess the maximum of flavor and are well suited for making butter, jams, syrups, and combination jellies. They are apt to be lacking in

[1] After C. A. Browne.

pectin, especially such fruits as, grapes, blackberries, and raspberries, and should not be used for making pure jellies.

4. *Stale Fruits.*—Stale fruits are those that have been in storage or on the market for such length of time that they have begun to deteriorate. Both the acids and sugars have decreased. The pectin has become hydrolized and as a rule a bitter taste or rancid flavor has been developed. Such fruits should be used sparingly only in combinations if at all.

B. The Cooking Period.—The length of the cooking and the rate at which it proceeds have a profound effect upon the color, flavor, and consistency of all fruit products. Cooking performs two major functions, (1) it makes the fruit tender, soft and more porous which greatly facilitates many subsequent processes or if sufficiently prolonged many fruits are reduced to a finely divided condition, i.e., they are broken down into a pulp. This type of cooking is usually carried on at a slow boiling in a covered vessel. In a few cases the temperature is lowered to the simmering point, around 200° F. but unless specified; cooking, as defined above, means maintaining the temperature at the boiling point of the material with just sufficient heat to produce slow to moderate boiling. (2) It causes a reduction in volume due to the evaporation of a part of the water. This is generally referred to as *concentration.* Cooking for this purpose should proceed at rapid boiling in an open kettle. It must be self-evident, then, that rate of cooking and length of cooking period are closely related if a definite amount of concentration is desired.

Prolonged cooking after the sugar is added has a decided effect upon the finished product. (1) It causes a darkening of the color, which in a few cases is desirable but as a rule is undesirable. (2) It tends to develop a caramel flavor which lowers the quality of the product. (3) It affects the consistency by breaking down the pectin making the products syrupy or sticky rather than jelly-like. The operator must not forget that the proper amount of cooking is the greatest single factor in determining the consistency of practically all fruit products.

C. The Added Sugar.—Under the conditions found when our grandmothers practiced the art of food preservation sugar came to be regarded primarily as a preservative in all manufactured fruit product. Modern development has changed our viewpoint and we of today set forth a number of functions which sugar performs in our methods of food preservation:

1. It adapts the finished product to the taste.
2. It aids in giving the proper consistency.

3. Properly manipulated, it will have a controlling influence on the texture.
4. Under certain conditions and with certain products it is relied upon for preservation.

1. *Sugar Adapts Products to Taste.*—Before the advent of the inexpensive hermetically sealed container the use of large amounts of sugar was necessary to prevent fermentation. It became the common practice to use approximately equal amount of sugar and fruit for practically all fruit products. This habit was fixed upon the earlier generation through necessity. But now that we may preserve our fruit products in hermetically sealed containers we may add sugar to our fruits in the ratio that will give the taste we desire and that will leave the natural flavor of the fruit practically unimpaired. However, under certain conditions we still rely upon sugar to preserve our products. Rarely will a jelly set until its sugar concentration is sufficient to prevent fermentation. A few very acid fruits require such a large ratio of sugar to render their products palatable that they almost automatically are preserved with sugar. But the greater number of modern fruit products do not contain enough sugar to preserve them in open containers.

2. *Consistency Affected by Sugar.*—We know from experience that as we increase the ratio of sugar to fruit the consistency of most kinds of fruit products become more syrupy. Naturally then if a jelly-like or cheese-like consistency is desired the ratio of sugar to fruit must not run too high. On the other hand, too small a ratio of sugar will cause toughness in jelly-like products. Somewhere then between these extremes the operator will find the optimum ratio of sugar to add to each and all products which together with proper cooking will give ideal consistency.

3. *Texture Affected by Sugar.*—Most fruits, especially acid fruits, when cooked in water or in their own juice tend to break down into a fairly uniform pulp. The same fruits when cooked in a light sugar syrup tend to hold their shape. This latter fact is taken advantage of in the manufacture of those fruit products where an uneven or lumpy texture is desired. If a smooth, even texture is sought, the sugar is not added until the fruit has been cooked to a pulp either in water or in its own juice.

4. *Preservation* (see Method of Storing as Affected by Sugar Ratio, page 107).

(*a*) The Ratio or Amount of Sugar.—As a general rule too much sugar is added to fruit products. The practice of using equal

amounts of sugar and fruits or fruit juices has come down to us from a past generation and there are still many who believe this practice to be necessary. The proper ratio of sugar and fruit is determined by a number of factors, among which the following are the most important:

1. Character and kind of fruit
2. Kind of product and its use
3. The taste of the consumer
4. The cost of manufacture
5. Method of storing the finished products.

1. Character and Kind of Fruit: Varieties and kinds of fruits vary greatly in their acid-sugar ratio. Also the same variety of fruit has a wide range in its acid-sugar ratio at different stages of its development, as has been shown on page 103. If then one of the functions of sugar is to adapt the finished product to the taste the ratio of sugar to fruit will vary according to the acidity of the fruit. Acid fruits like cranberries require a much higher ratio of sugar than do the less acid, like raspberries.

2. Kind of Product and Its Use: It should be obvious that since different kinds of fruit products are often used for different purposes their sugar content should vary. Jellies and preserves are among our sweetest products whereas jams are less sweet and butters and conserves have the least ratio of sugar added to them. Also the same type of product may be intended for two distinct uses; for example, currant jelly or apple butter may be used as a spread for bread, in which case they should have enough sugar added to give them a sub-acid taste, whereas if they were intended for use as a relish the sugar ratio would be reduced to give them a tart taste.

3. The Taste of the Consumer: There is a relatively wide range in consumers' tastes, some demanding sweet, others sub-acid and still others preferring a tart taste. Knowing the consumer's preference, the operator will be able to make the ratio of sugar to fruit such as will give satisfactory results. Reducing the sugar ratio will give greater concentration and thereby increase the acid content, and vice versa. This principle holds true with all fruit products. Therefore it is possible to vary the taste of a given product over a range from tart to very sweet by changing the sugar-fruit ratio.

4. Cost of Manufacture as Affected by Sugar: Most fruit products are made by combining two materials—sugar and fruits. Any marked variation from the optimum ratio in which these materials are normally combined will affect not only the quality but the cost as well. If fruit is cheap any material increase in the sugar ratio will increase the cost

per unit package, but if the fruit is expensive increasing the ratio of sugar will reduce the cost per unit package. These facts give the manufacturer an interesting problem if he desires to produce maximum quality at minimum cost.

5. Method of Storing as Affected by Sugar Ratio.—If the finished fruit product is to be a jelly or some product that is to be stored in hermetically sealed containers, the operator may choose that ratio of sugar to fruit which will give the desired taste. We know there will be enough sugar in the finished jelly to preserve it under ordinary storage conditions and we can rely upon the hermetically sealed container to preserve other products. But if the products must be stored in open or paraffin-covered containers then the ratio of sugar must be such as to give a product whose sugar content will preserve it. As a rule the minimum ratio that can be depended upon to preserve all fruit products in unsealed containers (jellies and cranberry sauce excepted) is two-thirds as much sugar as fruit. The use of less than this will invite disaster.

The general rule which the operator may formulate from all the foregoing discussion might be summed up as follows:

The proper ratio of sugar to fruit is the one that will give a mild sub-acid taste (*or the taste desired*) to most products; and if the sugar ratio falls below 2 : 3 the finished product (except jellies and cranberry products) must be preserved in hermetically sealed containers.

(*b*) Time to Add the Sugar.—Just when to add the sugar is a problem for further investigation. In the manufacture of most preserves and in cooking where sugar is used to prevent the pulping of fruits during the earlier stages of cooking we have no choice in the matter. At least some of the sugar must be added at the beginning of the cooking period. But when making other products the conditions are different. Through long experience it has been fairly well established that if the sugar is added too early in the cooking period there will be found: (*a*) some loss in sweetening value due to inversion of the cane sugar, (*b*) a darkening of the color of the finished product, (*c*) a tendency to develop a caramel flavor, and (*d*) a syrupy rather than a jelly-like consistency in the finished product.

On the other hand if the sugar is added too near the close of the cooking period there is the possibility that some of it will crystallize out after standing. This is most likely to occur in jellies made from subacid fruit and in other fruit products which receive a relatively high ratio of sugar. Somewhere then between these extremes must be the ideal time to add the sugar for best color, consistency, flavor, and freedom from sugar crystals. This time no doubt varies with different

products, with the ratio of sugar and rate of cooking and the acidity of the fruit. A general rule which has proven satisfactory is given here for whatever it may be worth to the beginner.

The best results have been obtained when the sugar is added 5 to 10 minutes before the close of the cooking period. This requires the greater amount of concentration before adding the sugar and relatively little after it is added. Experience fails to show any worthwhile value in adding heated sugar as compared with unheated where products are made in relatively small quantities.

D. Economy in Production.—The cost of a manufactured fruit product generally determines its selling price and this in turn tends to limit the amount the average consumer can buy. Or if intended for use in the home the cost will as a rule decide how much one can afford to make. There are many ways by which the cost may be lowered. Some of these are legal some are illegal. All legal means should be used insofar as they do not seriously impair the quality and appearance. Some of the legal means of reducing the cost of production are:

1. *Multiple Extraction of Juice in Jelly Making* (see page 136).—By this means the jelly yield may be almost doubled over the old method of a single extraction. In practically every case multiple extraction will improve both the quality and appearance.

2. *Blending.*—The blending of two or more materials will often give an improved product at a reduced cost. Highly flavored and aromatic fruits may well be blended with less desirable sorts. Expensive fruits such as raspberries may be combined with apple in order to improve both the consistency and quality (see Combination Jellies, page 151).

3. *Reduction of Sugar Ratio.*—A reduction in the sugar ratio to a minimum will not only improve the quality of many fruit products but it will reduce the cost of most of them. In the case of expensive fruits this is not true.

E. Equipment.—The equipment for home or laboratory work need not be extensive or expensive. The most important item is the source of heat. Gas is the most satisfactory, with kerosene and wood or coal range in order named. Gas or kerosene should be available if possible because of greater comfort and ease of control and because better results may be had than where the range is used. Practically all the other equipment may be found in any well-ordered kitchen. The kettles used for cooking should be aluminum, porcelain or enamel ware. As a general rule aluminum is less expensive since it will stand up under rough usage for many years. The spoons for stirring and testing may be of metal or wood. The latter are preferred for stirring. A good colander, also wire sieve, a food chopper with several sizes of cutters,

a measuring cup, kitchen scales, and several squares of cheesecloth will complete the essential home equipment.

F. The Operator.—The operator and the methods employed comprise the final determining factors in the manufacture of high quality fruit products. If the operator can find enjoyment in the work and is willing to learn in order that he may apply his energies intelligently rather than to follow blindly rule of thumb methods he need have little or no fear of failure.

The beginner should first be sure he understands just how every operation in the process is performed, then hold rigidly to the instructions at hand. One should avoid mixing two sets of instructions. Nor should the beginner attempt making short-cuts. Ability to do this comes only with experience.

Absolute cleanliness and careful manipulation to prevent scorching or carmelization of products are the watchwords to success in manufacturing fruit products of high quality and attractive appearance.

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CHAPTER XI

FRUIT BUTTERS

Fruit butters are made from the pulps of fruits; the seeds, skins and cores being discarded. The texture is uniform, smooth and fine. The consistency is such that the butters are soft, will spread easily and do not contain any free liquid. Two kinds of butter are commonly made: (1) That intended for a spread, which is sweetened with sugar to a mild sub-acid taste and which is generally spiced; (2) that intended to be eaten as a relish, which as a rule is sweetened very little or not at all—spices may or may not be added. The flavor of all butters should be characteristic of the fruit from which they are made.

The fruit butters should be classed among our most important fruit products. They are relatively easy to make, are less expensive than most fruit products and are more healthful than many of the sweeter jams and jellies. They offer a means of utilizing fruits which are not suitable for canning nor for general market as fresh fruit.

As a rule, butter is made from the fleshy fruits such as apples, pears, peaches, plums and grapes. Butters differ from jams in that they do not contain any seeds but are made from pulp only. They are different from marmaldes in that their texture is smooth and even and also as a rule, they contain only one fruit, although combinations are in some cases most desirable.

Fruit butters are to be recommended especially as substitutes for the more expensive, sweeter jellies and preserves. Their sugar content is relatively low and they may be eaten in liberal quantities without injury to health.

Sugar Ratio.—The amount of sugar to be added in making fruit butters depends upon the acidity of the fruit. A well-made butter should have a sub-acid to a tart taste. No hard and fast rules can be laid down here, and, in the specific directions which follow, only close approximations can be given. One very important fact that must be kept in mind is that an excess of sugar will mask the characteristic taste and flavor of the fruit and the butter will have lost its value as a substitute for the sweeter fruit products.

Storing.—Fruit butters made according to methods given here will not, as a rule, keep well in open containers. They should be filled

while hot into clean, dry containers which are subsequently partially sealed and processed in boiling water for 3 to 5 minutes.

Methods of Manufacture.—The older methods of making fruit butters required long periods of tiresome stirring in order to secure desired texture and consistency. Modern methods have reduced the length of the cooking period and simplified the work of preparing the fruit. In commercial manufacture the stirring has been eliminated through the use of the steam coil and the steam jacket kettle, whereas the pulping machine and cradle colander have done away with peeling, coring and pitting.

In home methods the colander, the ricer and the sieve have taken the place of peeling and coring, but no satisfactory substitute has been found for the stirring operation. During the earlier part of the cooking when only occasional stirring is necessary a spoon may be used successfully. But toward the close of the cooking period when the boiling pulp is apt to sputter considerably, serious burns may result if stirring is done with a spoon. In order to overcome this danger and discomfort directions are given below for constructing a butter stirrer.

Butter Stirrer.—A piece of white wood or maple ½ inch thick, 3 inches wide and with a length 3 or 4 inches greater than the depth of the vessel will serve as the paddle or upright piece. A half-inch hole is made through the side about one inch from one end. In this hole is fastened a smooth, light stick 3 feet long. The stirrer is operated by grasping the handle near the free end and manipulating in such manner as to cause the lower end of the paddle to move back and forth across the bottom of the kettle. The operator is removed from the heat of the stove and is beyond the danger zone of the sputtering butter. An improvement may be made by fastening a sheet of cardboard in a horizontal position to the top of the paddle and to the handle. This will prevent the sputtering butter from flying out over the stove and floor.

APPLE BUTTER

Home Method.[1]—The amount of apple butter which may be made at one cooking will depend upon the size of available cooking vessel. The kettle in which the cooking is made should be porcelain, enamel lined, or of aluminum or copper. It should have a capacity of 10 to 12 quarts, if as much fruit as will yield approximately 1 gallon of butter is to be cooked.

For each peck or twelve pounds of fruit the following materials will

[1] For Farm-factory method see Chapter XXI.

be needed: One gallon of sweet cider, 1 to $1\frac{1}{2}$ pounds of sugar, 1 tablespoonful of cinnamon and one-half tablespoonful of cloves.

The apples are thoroughly washed and the calyxes and all undesirable parts are removed. They are then cut into thin slices and together with the sweet cider are placed in the vessel in which they are to be cooked. The boiling should be only moderate during this period since the object is to cook the fruit to a sauce. An occasional stirring should be given in order to secure uniform cooking. When the fruit has been reduced to a thin lumpy sauce it is run through a kitchen colander. This operation tends to give a uniform texture in addition to removing the seeds, skins and cores. If an extra fine texture is desired the

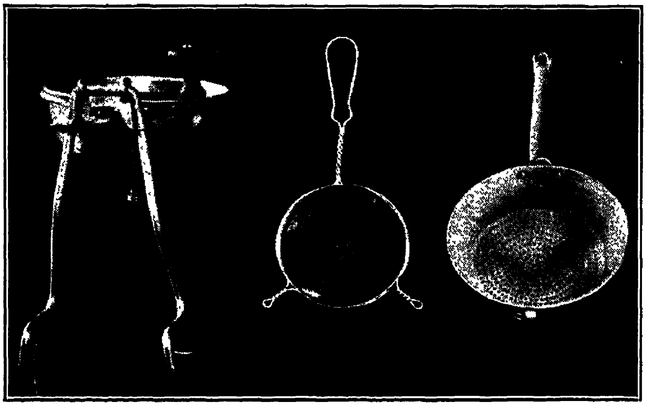

FIG. 28.—Equipment for pulping and for removing seeds, skins, etc. Reading from the left they are, vicer, sieve, colander.

pulp may be run through a fine-meshed wire sieve. A fruit jar or jelly glass is an excellent tool for forcing the pulp through the colander.

The fine sauce is returned to the kettle and boiled moderately with constant stirring until it is thick enough to heap, or round up on a spoon. The sugar, with the spices mixed with it, is now added and the cooking is continued until the boiling material will heap up well on a spoon and will flow from the spoon in sheets.

The hot butter is filled into clean, dry jars. The jars are then partially sealed and processed in a hot water bath for 2 or 3 minutes. This is necessary to insure perfect keeping. If not processed it may ferment and will be almost sure to mold.

If a tart butter is desired the amount of sugar may be reduced sufficiently to produce the desired taste. The larger amount of sugar given above would be used only with the more acid varieties of apple.

If sweet cider is not available a quart of boiled cider and 3 quarts

of water may be substituted. Apple butter may be made without cider. Water is used to secure the necessary amount of cooking. The quality of the finished butter will be much below that made with cider but a fairly acceptable product for home use may be made in this way.

GRAPE BUTTER

There is one difficulty attending the manufacture of concentrated grape products that is not encountered with any other fruit. Grapes have a relatively high acid content in the form of an acid potassium tartrate. This will often crystallize out in the finished product in what is technically known as "argol" but which is popularly known as "cream of tartar."

When this crystallization takes place in a liquid like grape juice, the crystals settle to the bottom and no particular harm results since the clear juice may be decanted or the crystals may be strained out. If it occurs in jelly the only remedy is to manufacture the jelly into some other product like mince meat, conserves or marmalades.

If the crystals develop in butter, jam or marmalades these products may be heated for a few minutes at the boiling point and the crystals will disappear. They will, however, develop again after a lapse of a few weeks.

No practical method is known for eliminating this difficulty in connection with pure grape products such as marmalade and butter. Adulterated products are less liable to develop this trouble since the point of concentration is less if an extender is used or the acidity is greatly reduced when juice is taken as a product and the butter or marmalade is made as a by-product. Most varieties of red and purple or black grapes will make good butter. The fruit should be ripe in order to secure the best flavor and taste.

Pure Grape Butter

The grapes are removed from the bunches and washed. One cup of water is added to each 5 pounds of fruit. The cooking is done at slow boiling with occasional stirring. When the berries are well broken up the pulps are rubbed through a colander or fine sieve. The fine sieve will give a more uniform texture to the finished butter. The pulps are returned to the kettle and if the consistency is thin they are boiled rapidly with constant stirring. When the hot pulps will round up somewhat on the spoon the sugar is added. The proportion of sugar will vary depending upon the use for which the butter is intended.

If for a spread the proportion should be one-third to one-half the weight of prepared fruit. If the butter is to be used for a relish one-fourth as much sugar as prepared fruit is required.

When the sugar is added the cooking should progress rapidly in order to avoid a caramel flavor. When the boiling materials will round up on a spoon or will flow from the spoon in sheets or flakes the butter is finished.

The hot butter is poured into clean, dry jars, filling them full. The jars are partially sealed and processed in the hot water bath for 2 or 3 minutes.

Grape Butter as a By-Product of Grape Juice.—The berries are picked from the clusters and thoroughly washed. One pint of water is added

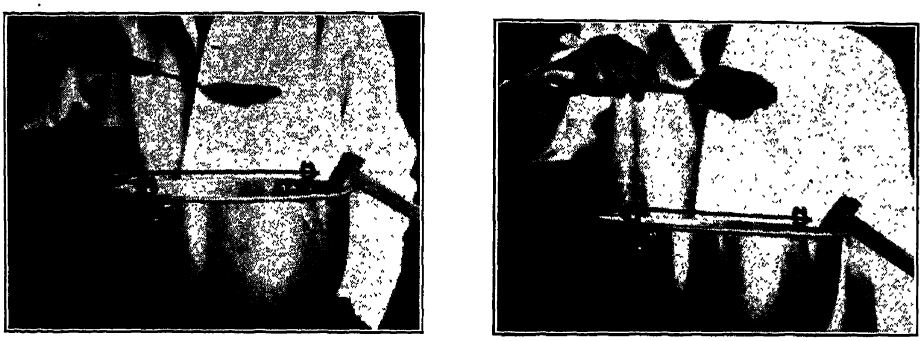

FIG. 29.—The finish test for butter. The hot butter will heap up on the stirring spoon (*left*) or it will flake from the lower edge of the spoon as in the jelly test (*right*).

to each 5 pounds of grapes. The cooking is done at a temperature of 165 to 175° F. and is prolonged until the berries are quite soft but not long enough to cause them to break up. The free run juice is strained off through one layer of cheesecloth and is used for grape juice. (See Grape Juice.)

The pulps are forced through a colander or fine sieve. The pulp is weighed and mixed with one-third its weight of sugar and is converted into butter as described for pure grape butter.

This makes a butter of good quality at very small expense.

GRAPE-APPLE BUTTER

This as well as the preceding is an adulterated product. It is made by introducing into the pulp obtained by either of the preceding methods, preferably the first, an amount of fine apple pulp not exceeding one-third the weight of the grape pulp. This small amount of apple

does not detract noticeably from the quality and flavor of the finished butter but it does lessen the cost and will reduce the danger of crystals forming. Butter of this quality, if properly labeled giving true contents, may be legally marketed. It should be stored as given under pure grape butter.

PEACH BUTTER

The fruit should be well ripened and if the fuzz is heavy the peaches should be peeled. The peeling may be done by means of a sharp knife or by scalding in the same way as in removing skins from tomatoes, or if being handled in quantity, the lye method of peeling may be used. If fairly free from fuzz a thorough washing only should be given. All undesirable spots should be removed and the fruit pitted. The cleaned and pitted fruit is placed in a cooking utensil with sufficient water to start the cooking, approximately one-half cup per pound of prepared fruit. When the fruit has been cooked tender it is rubbed through a fine sieve or colander to remove skins and fibers and to give a fine, even grain. The pulp is then cooked with constant stirring until quite thick, that is, until it will round up well on a spoon. The amount of sugar to be added will depend somewhat upon the variety of the fruit and will vary from $\frac{1}{4}$ to $\frac{1}{2}$ pound per pound of prepared fruit. After the sugar is added the butter should be cooked rapidly with constant stirring until of the desired consistency. Spices of kind and in amounts desired may be added just before removing from the fire. The spices should be stirred in thoroughly. The following combination gives a very good spiced product: $\frac{1}{2}$ teaspoonful of ground cinnamon and $\frac{1}{4}$ teaspoonful of ground cloves per pound of prepared fruit.

If the peaches are quite ripe and lacking in acid the quality of the finished butter may be greatly improved by adding 1 tablespoonful of lemon juice per pound of prepared fruit.

When finished the hot butter is filled into clean, dry jars, partly sealed and processed for 5 minutes in a hot water bath.

PLUM BUTTER

Plums differ so much in their acid content and in the relative amount of water or juice in them that it is somewhat difficult to give a definite method which will hold good with all species and varieties. As a general rule the European plums, except the Damsons, are rather dry fleshed and of sub-acid to sweet taste. The Japanese varieties show a wide range of variations, Red June being very soft and juicy whereas Burbank is firm fleshed and fibrous. The Native or American

plums are all fairly juicy, sub-acid to acid and many have a bitterish taste.

As a general rule the sub-acid to acid varieties are best for butter. The juicy plums are better adapted for jelly than for butter, although excellent butter can be made from most juicy plums.

The first step is to rid the plums of their skins and pits. This is generally accomplished by cooking the washed fruit in a small amount of water varying from a half cup per pound of fruit for juicy plums to a cup for the less juicy varieties. The cooking should proceed at slow boiling with frequent stirrings until the pulp is freed from the pits. The soft pulp is then rubbed through a colander to free it from pits and skins. The pulp as it comes through the sieve will vary considerably in its consistency. If very thin it should be returned to the fire and boiled rapidly with frequent stirring to prevent scorching until the hot pulp will round up somewhat on the spoon. The sugar is now added and must be in proportion to the acidity of the fruit. The amount of sugar will vary from one-third to three-fourths the weight of the fresh fruit if butter is to be used as a spread; if butter is intended to be used as a relish less sugar will be required.

After the sugar is added the cooking should proceed rapidly until the finishing point, which is reached when the butter will either heap up on a spoon or will flake from the spoon similar to jelly test.

The hot butter is then filled into clean, dry jars partially sealed and processed for 2 to 3 minutes in a hot water bath.

Plum Butter as a By-Product.—An excellent grade of butter may be made from red plums as a by-product of jelly making. The washed fruit is cooked in an equal amount of water until the skins begin to slip off and is then allowed to stand for 15 minutes in the hot juice. The free-run juce is strained off through a single layer of cheesecloth and is used for jelly while the pulps are returned to the kettle and cooked slowly until the pulp readily frees itself from the pit. The process is then the same as described above except that the amount of sugar is reduced about one-third.

CHERRY BUTTER

Although this product is not strictly a butter according to our definition of fruit butters, it fits as well here as in any other group of fruit products. When properly made from good sour cherries, preferably some one of the dark red varieties, such as English Morellow, it ranks among our choicest fruit products.

The cherries are pitted and run through a food chopper, using the fine cutter. For each pound of chopped fruit $\frac{3}{4}$ to 1 pound of sugar is

allowed depending upon taste. The fruit is brought to the boiling point, then the sugar is added and boiling is continued until the syrup will almost give a jelly test or the hot pulp will round up on the stirring spoon. The hot butter is filled into clean, dry jars, partially sealed and processed for 2 or 3 minutes in the water bath.

REFERENCES

See Chapter X, Fruit Products.

CHAPTER XII

CONSERVES AND MARMALADES

CONSERVES

Conserves are fruit products made by blending together two or more fruits to which as a general rule nut meats are added. Some parts or all the fruits may occur in slices, shreds or chunks, giving an uneven texture. The consistency is soft, easily spread and free from appreciable amount of liquid or if present the liquid is a very heavy syrup or soft jelly. The taste should be sub-acid and the flavor generally that of the dominant fruit blended with and modified by that of the other fruits and the nut meats.

Discussion.—Formerly the presence of nut meats was regarded as the distinguishing character of a conserve. Lately, however, there has developed a growing tendency to apply the term conserve to almost any blend or mixture of fruits even if it does not carry nut meats in its composition. This is unfortunate since it tends to confuse any rational system of classifying fruit products. A plea is here made to restore to the word conserve its original meaning and to classify these so-called conserves with the marmalades and jams where they more properly belong.

Types of Conserves.—A conserve generally consists of one major or dominant fruit blended with one or more others in such amounts that the flavor of the major fruit is merely blended with that of the others. Conserves of this type are named for the dominant fruit flavor such as cherry conserve, cranberry conserve, etc. Other conserves consist of approximately equal amounts of two or more fruits combined with others in less amounts. Such conserves do not have the characteristic flavor of any one fruit but rather a blend of the flavor of all the fruits used. These conserves are known by whatever name the designer may give them. Raisins and some one or two citrus fruits usually constitute a part of conserves. The raisins are omitted from the lighter colored conserves unless white raisins are available. Of the citrus fruits both lemons and oranges are used—lemons when high acidity is desired, and oranges if the other fruits are fairly acid. The skins of both give a pleasing bitterish taste.

Any of the recipes which follow may be varied to suit individual taste or new combinations may be made. Only a few recipes which have proven satisfactory to a large number of consumers are given. These together with the general principles laid down will enable the operator to devise other and possibly more acceptable combinations.

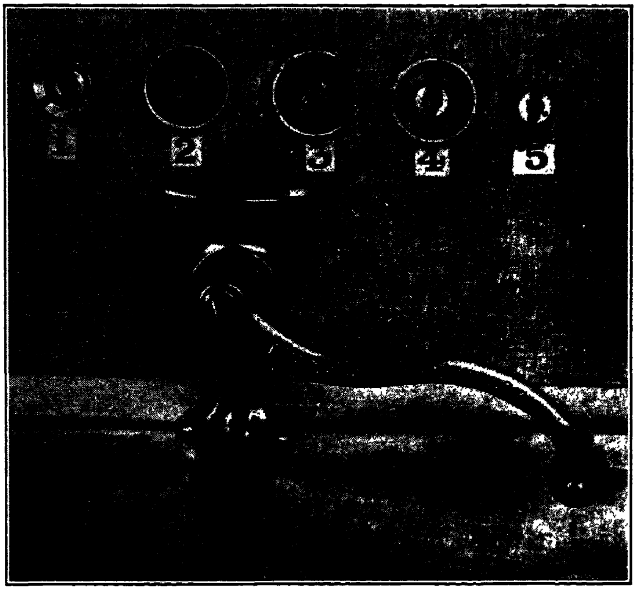

FIG. 30.—The kitchen type of food chopper with the regular sizes of cutters ranging from very fine (1) to very coarse (5).

Storing Conserves.—With the exception of rhubarb and cranberry conserves the sugar content in the following conserves is not sufficient to keep them in open or paraffined-cap containers. The two exceptions named have such high acid content that they may be safely stored in open containers provided the consistency is not too thin.

Nut Meats.—Walnut meats are generally preferred. They should be cut, broken or chopped in order to insure more even distribution. They should not be added until the conserve is finished. It is best to allow a 3- to 5-minute cooling before stirring in the nut meats since they tend to float to the top of the heavy conserve. In some cases, nut meats will cause the conserve to turn dark, often showing black areas only around the pieces of nut meat. This may be corrected to a very large extent by blanching the nut meats in boiling water for 3 to 5 minutes and then cooling in cold water.

Cherry Conserve

The dark-red cherries make an excellent conserve when combined in the following proportions: 1 quart cherries, 1 medium size orange, 2 ounces of raisins, 1 or 2 ounces of walnut meats and enough sugar to give a sub-acid taste—approximately $1\frac{1}{4}$ pounds. The orange is run through the food chopper, using the fine cutter, and is boiled slowly with 1 pint of water for 20 to 30 minutes. The cherries are pitted and run through the food chopper together with the raisins. The nuts may be broken, cut with a knife or run through the food chopper, using medium coarse cutter. When the orange has cooked tender the cherries and raisins are added and cooking proceeds at rapid boiling. When approximately half the juice has evaporated the sugar is added and rapid boiling is continued until the hot pulp will round up on the spoon or will sheet or flake from edge of spoon. The finished conserve is removed from the fire and allowed to cool for 3 to 5 minutes, after which the nut meats are stirred in and the conserve is then filled into clean, dry jars, partially sealed and processed in the water bath for 2 or 3 minutes.

Cranberry Conserve

The proportion of fruits in making cranberry conserve is as follows: Cranberries, $1\frac{1}{2}$ pounds or quarts, $1\frac{1}{2}$ ounces raisins, 1 ounce walnut meats, $\frac{1}{2}$ medium-size orange, $1\frac{1}{4}$ pound sugar. The procedure is the same as given for cherry conserve.

Rhubarb Conserve

The rhubarb should be young and tender. It is trimmed, washed and cut into half-inch lengths. For each pound of prepared rhubarb the following materials are required: one medium-size orange, 1 ounce of blanched walnut meats and 1 pound of sugar. The orange is chopped fine and cooked for 20 to 30 minutes in 1 pint of water. The rhubarb is added and cooked until soft. The sugar is added and cooking continued at rapid boiling until the hot material will round up on the spoon or will sheet or flake from the edge of the spoon. After cooling 3 to 5 minutes the blanched nuts, cut fine, are stirred in and the conserve is filled into clean, dry glasses or jars. Glasses are paraffined when cold and jars are partially sealed and processed in the water bath for 2 or 3 minutes.

Mixed Fruit Conserve

The fruits should be hard-ripe and are used in the following proportions: 1½ pounds peaches, 1 pound quinces, 1 pound pears, 1 pound sour apples, ¼ pound raisins, one medium-size orange, 2 or 3 ounces blanched walnut meats and 2 pounds of sugar.

The peaches are peeled and pitted, the pears and apples are pared and cored, the orange is cut into quarters and seeds and white core removed. The raisins are washed. The nut meats are blanched in boiling water for 3 to 5 minutes, cooled in cold water and cut fine. The fruits are all run through the food chopper using medium coarse cutter. They are thoroughly mixed and are then placed in a vessel in alternate layers with the sugar and allowed to stand for 10 or 12 hours or overnight. The fruits are cooked for 15 to 20 minutes at slow boiling or until the fruits are tender. After this they are boiled rapidly until the hot pulp will round up on the spoon or will sheet or flake from the edge of the spoon. After cooling for 3 to 5 minutes, the nut meats are stirred in and the conserve is filled into clean, dry jars, partially sealed and processed in water bath for 2 to 3 minutes.

Note.—Both color and consistency will be improved if the orange and quince are prepared one day in advance and are given a slow boiling for one hour in sufficient water to prevent scorching.

Gooseberry Conserve

The fruits should be at least half ripened. They are used in the following proportions: 1 quart gooseberries, 1 small orange, 2 ounces raisins, 1 to 2 ounces blanched walnut meats and 1¼ pounds sugar. The blossoms are removed from the gooseberries and from this point on the method is the same as given for cherry conserve.

Damson Plum Conserve

Well-ripened damson plums may be combined as follows: 2 pounds plums, 1 orange, ¼ pound of raisins, 3 or 4 ounces walnut meats, and 1½ pounds sugar. The plums are halved and pitted, then run through food chopper, using the medium coarse cuttter. From this point on the method is the same as that given for cherry conserve.

Grape Conserve

A good grape conserve may be made by using the following materials: 2½ pounds of well-ripened grapes—preferably a black variety, 1 medium-

size orange, 2 ounces walnut meats, and 1½ pounds sugar. The grapes are washed and pulped by pressing the berries between the thumb and finger. The skins together with the orange are run through the food chopper, using the medium fine cutter. These are boiled slowly with 1 pint of water for 20 to 30 minutes or until the small pieces of orange peel are tender. The pulps are boiled with 1 cup of water until they are cooked to pieces, after which they are forced through a colander to remove the seeds. The pulps are added to the orange and grape skin mixture and boiled until thick enough to round up somewhat on the spoon; then the sugar is added and boiling proceeds at a rapid rate until the hot material will sheet or flake from the edge of the stirring spoon. After cooling for 3 to 5 minutes, the finely chopped nut meats are stirred in and the conserve is filled into clean, dry jars, which are partially sealed and processed in the water bath for 2 to 3 minutes.

MARMALADES

As a general rule marmalades are made from pulpy fruits. The pulp and juice only or the entire fruit except core and seeds may be used. The pulp (and skins when used) occurs in the finished product in slices, shreds or small pieces and should be evenly distributed. Marmalades may be made from a single fruit but as a rule two or more fruits are blended. The texture is uneven, the consistency, technically, should be jelly-like, that is, the juice and sugar should form a jelly throughout which the pieces of pulp are uniformly distributed. They are, however, frequently quite soft with a tendency to flow. The taste should be sub-acid, often bitterish in citrus marmalades, and the flavor either is characteristic of the fruit or is a pleasing blend.

Marmalades differ from conserves in that they do not contain nut meats and that very seldom if ever are raisins used. They are different from butters in that they have an uneven texture. They more nearly resemble jams than any other group of fruit products. The same general principles governing the manufacture of fruit products apply to the making of marmalades. But generally each particular marmalade calls for some special manipulation of a part or all the materials. Many of the so-called conserves should be placed in this group even though a small amount of some seedy fruit is used in its manufacture.

Apricot-Pineapple Marmalade

The materials required are as follows: 1 pound dried apricots, 1 pound of pineapple, 2 to 2½ pounds sugar. The apricots are soaked

overnight in $1\frac{1}{2}$ pints of water. They are then run through the food chopper, using the coarse cutter. The pineapple is peeled, cored, cut into slices and run through the food chopper, using the medium coarse cutter. The chopped pineapple is cooked in 1 pint of water in a covered vessel for 30 to 40 minutes. Rapid boiling in open kettle is then maintained until the fruit is almost free from water. The apricots and sugar are added and the mixture is boiled with frequent stirring to prevent burning. It is finished when the pulp will round up well on the stirring spoon or when the syrup almost gives the jelly test. The hot

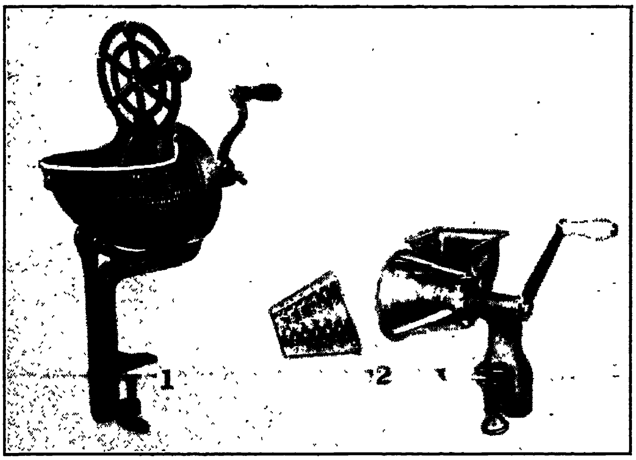

FIG. 31.—1. Slicer. 2. Combined slicer and grater.

marmalade is filled into clean, dry jars. The jars are sealed and processed in the water bath for 2 to 3 minutes.

APPLE MARMALADE (ORIENTAL)

The apples should be ripe but firm. Those that are quite acid are best. The fruit is peeled, cut into quarters and cored. For 2 pounds of prepared fruit 1 lemon, 1 ounce of preserved or crystallized ginger, $2\frac{1}{2}$ quarts of water, and 2 pounds of sugar are required. The apples, lemon and ginger are run through the food chopper; the coarse cutter is used for the apples and the fine cutter for the lemon and ginger. The fruit and one-half the sugar are added to the water and boiled in open kettle until the fruit is clear and the mixture has been concentrated until the volume is reduced one-half. The remaining sugar is added and boiling is continued until the syrup gives a jelly test. The hot marmalade is filled into clean, dry jars and they are processed for 3 to 5 minutes in the water bath.

Citrus Marmalade

Citrus marmalade is made by combining the three principal citrus fruits. The proportions of these may vary over a wide range. The following recipe has given satisfactory results, in laboratory practice, over a period of several years: Two large oranges, either Florida Sweets or Navels, 1 large lemon, $\frac{1}{2}$ medium-size grapefruit, and $1\frac{1}{2}$ to 2 pounds of sugar. The fruits should be thoroughly washed and their skins scraped to remove any traces of foreign materials such as rust, scale, etc. They are then cut into eighths and all seeds and white core are discarded. The pieces to be used may be cut into thin slices with a sharp knife; they may be run through a slicer, if one is available; or they may be put through the food chopper, using a medium fine cutter. When the fruit is all sliced better results will be had if further procedure is based upon weight of raw materials. The amounts given above will average between $1\frac{1}{4}$ and $1\frac{1}{2}$ pounds.

The sliced or chopped fruits are placed in a saucepan and water equal to 3 pints per pound of fruits is added. The fruit is brought to slow boiling and boiled for 30 to 45 minutes or until the pieces of fruit are tender. It is then set aside overnight. The next day the pulps and juice are measured. There should be approximately 1 quart for each pound of fresh fruit. If the amount is more than this it is concentrated to that amount by rapid boiling. The sugar is added and rapid boiling is continued until the hot syrup will give the jelly test if a firm marmalade is desired. The finished marmalade should cool for 3 to 5 minutes in order to insure uniform distribution of solids. After cooling it is filled into clean, dry jelly glasses, filling to within $\frac{1}{4}$ inch of the top. When cold and set the exposed surface is covered with a thin layer of paraffin, the metal caps are applied and the glasses are stored.

Peach Marmalade

The firmer-fleshed peaches, such as Elberta, Crawford and Hale, are more suitable for marmalade. Georgia will yield a marmalade of exceptional flavor but, being white-fleshed, the finished product lacks attractiveness. The fruit should be well ripened but not soft. The peaches are peeled and pitted, the halves may be cut into thin slices or small cubes or they may be run through the food chopper using the medium coarse cutter. Each pound of prepared fruit will require $\frac{1}{2}$ pound of sugar and $\frac{1}{2}$ cup of water; one-half the sugar is dissolved in the water and the prepared fruit is added and boiled slowly until the pieces are tender. At this point the remainder of the sugar is added

and rapid boiling is maintained until the syrup shows a tendency to sheet from the spoon as in the jelly test. After cooling for 3 to 5 minutes the marmalade is filled into clean, dry jars which are then partially sealed and processed in the water bath for 2 to 3 minutes.

Pear Marmalade

The fruit should be well ripened but not soft. It is peeled, cored and run through the food chopper using the coarse cutter. For each pound of prepared pears the following materials are required: $\frac{3}{4}$ pound sugar, $\frac{1}{2}$ lemon, chopped fine, $\frac{1}{2}$ cup finely chopped pineapple and $\frac{1}{2}$ cup water. The fruits are boiled in the water at slow boiling for 20 minutes. The sugar is then added and boiling is continued until the syrup gives the jelly test. After cooling for 2 to 3 minutes the marmalade is filled into clean, dry jars. The jars are partially sealed and processed at 180° F. for 20 minutes or at boiling temperature for 3 to 5 minutes.

Plum Marmalade

Plum marmalade may be made in the same manner as given for peach marmalade except that the fruit may or may not be peeled and the ratio of sugar must be increased to $\frac{3}{4}$ pound per pound of prepared fruit, if the more acid plums are used. The juicy varieties of plums are better suited for butter or jelly. The meaty, firm-fleshed plums are best for marmalade. The skins will be less troublesome if the fruit is run through the food chopper previous to cooking.

Rhubarb-Pineapple Marmalade

The rhubarb should be young and tender. The top and the hard portion at the base of stalk are discarded and the rhubarb is weighed. With each 2 pounds of rhubarb, 1 medium-size orange, 6 to 8 ounces of finely chopped or grated pineapple and $1\frac{1}{2}$ pounds of sugar are used. The rhubarb is cut into half-inch lengths; the orange is run through the food chopper; the pineapple is peeled, cored and chopped or grated. The fruits together with 1 cup of water are boiled slowly for 15 to 20 minutes or until the orange peel and pineapple are tender. The sugar is added and rapid boiling is maintained until the syrup will sheet or flake from the edge of a spoon as in the jelly test. After cooling 3 to 5 minutes the marmalade is stirred, filled into glasses to within $\frac{1}{4}$ inch of the top. Next day a thin layer of hot paraffin is added and the glasses are covered.

Quince-Apple-Cranberry Marmalade

The materials are required in the following proportions: ½ pound quince, ½ pound cranberry, ½ pound apple, 1½ pounds sugar, 1 pint water.

The apple and quince are peeled, cored, and either diced or cut into thin slices. The quince is cooked in water to cover until tender. Sufficient water is added to make up the required pint. The cranberries, which have been run through the food chopper, and the apples are added. After 5 minutes' slow boiling the sugar is added and cooking is continued at moderate boiling until the syrup almost gives the jelly test.

The hot material is filled into clean, dry jars. The jars are partially sealed and processed in the water bath 2 to 3 minutes.

Quince Honey

Quince honey is made by cooking grated or finely chopped quinces in a heavy syrup to which lemon juice has been added. In preparing the quinces care must be given to eliminate the gritty or concretionary material surrounding the core. The quinces are scrubbed to remove the heavy fuzz. They are peeled and grated or quartered, cored and run through the food chopper using the fine cutter. The syrup is made as follows: For each pound of prepared pulp 1 to 1½ pounds of sugar, 1 pint of water and the juice from 1 medium-size lemon are mixed and heated to boiling. The prepared pulp is added and cooking proceeds at slow to moderate boiling until the hot material gives the jelly test or to a temperature of 8 to 9° F. above the boiling point of water. The vessel is removed from the fire and the marmalade is allowed to cool 2 or 3 minutes before pouring. It may be poured into jelly glasses and paraffined when cold or it may be filled into clean, dry jars which are then partially sealed and processed in the water bath for 2 or 3 minutes.

REFERENCES

See Chapter X, Fruit Products.

CHAPTER XIII

JAMS

Jams are normally made from the small fruits. The entire fruit is cooked with sugar to the desired consistency which should be soft or jelly-like and contain practically no free liquid. The texture may be relatively uniform or quite uneven depending upon the fruit used and the method of manipulation. As a general rule jams contain but one kind of fruit, although the use of blends and mixtures is recommended. The taste of a jam should be sub-acid and the flavor characteristic of the fruit.

General Principles of Manufacture.—Jams of highest quality and most attractive color are made by cooking small quantities at a time. As the amount of material is increased the length of the cooking period is correspondingly lengthened resulting in lowered quality and darker color. From 1 to 3 or 4 quarts of fruit should be considered the proper batch for home manufacture.

The fruit should be well ripened in order to give the characteristic flavor and color to the finished jam. The soft, over-sized, misformed and very small fruits which are not suitable for canning, preserve, etc., may well be used in jams provided they are free from decay and are not stale.

The vessel in which jams are cooked should be of aluminum or some good type of porcelain or enamel ware. It should have at least double the capacity of the volume of fruit cooked. Metal spoons are not suitable for stirring. A wooden spoon or fruit-butter stirrer should be employed. A potato masher or ordinary fruit jar is an excellent tool for crushing the fruit. In some cases, for example, blueberries or small "nubby" strawberries, may be run through the food chopper with good results. As a general rule a small amount of water should be added to the fruit when cooking. This will lengthen somewhat the cooking period but a larger amount of pectin will go into solution in the juice, which greatly improves the consistency of the finished jam. Cooking should proceed at moderate boiling for 8 to 10 minutes before adding the sugar. If the sugar is added too soon the jam may acquire a caramel flavor due to too long cooking of the sugar. If the sugar is

added too late the jam will be gummy or paste-like. If the sugar can be added at such a point in the concentration that the after cooking period is about 5 minutes for a 1-quart batch or 8 to 10 minutes for a 2- or 3-quart lot the two extremes named will be avoided and the jam will have approximately the highest quality and color. Or it might be stated another way. If the amount of juice present is noted at the time the fruit reaches a vigorous boiling the sugar may be added with safety, when approximately half of this juice has been evaporated. The consistency of jams is largely determined by the amount of cooking and the time of adding the sugar. Finished jams will give a test very similar to that of jelly, that is, the syrup will sheet or flake from the spoon. The hot jam will also, as a rule, heap up on the spoon when it is lifted full from the boiling mass.

There is no fixed rule regarding the ratio of sugar to use in making jams. As a rule the ratio has been too high, resulting in an over-sweet jam which is eaten sparingly and without relish. By reducing the sugar ratio the jam can be given a subacid to tart taste. Such jams will be consumed in greater quantity because they do not cloy the appetite.

Jams made according to the specific directions which follow will not keep unless hermetically sealed. They should be filled into clean, dry jars (half, or quarter pints preferred), partially sealed as in canning, and then processed in the water bath at boiling temperature for 3 to 5 minutes, or in case of those which tend to develop froth and foam while processing they may be pasteurized at 180° F. for 10 to 15 minutes.

Blackberry Jam

The fruit should be well ripened and should have ripened on the bushes. The large, juicy, small-seeded varieties like Eldorado should be chosen in preference to the smaller, more seedy sorts such as Snyder.

The fruit is cleaned and thoroughly washed. The berries are placed in a vessel suitable for cooking and some or all of them are crushed. One cup water per quart of fruit is added. Heat is applied gently until the juice flows freely. Then boiling should be rapid until approximately one-half the free juice has been evaporated. The ratio of sugar will vary with the type of berries. The more acid fruits will require $\frac{3}{4}$ pound per quart while the sweeter sorts will give better jam if $\frac{1}{2}$ pound of sugar per quart is used. The cooking, after adding the sugar, should be rapid. The jam is finished when it will round up on the stirring spoon or when the syrup almost sheets or flakes from the edge of the spoon as in the jelly test. The hot jam is filled into clean, dry jars, partially sealed and processed in the water bath for 2 or 3 minutes.

Blueberry Currant Jam

A jam made by blending currants with blueberries is much superior to pure blueberry jam. The blueberries should be run through the food chopper using medium-fine cutter. One-half quart of currants is blended with each quart of blueberries. The currants are washed and without removing berries from the cluster they are cooked with 1 cup of water per quart of fruit at slow boiling in a covered kettle until the berries are soft—5 to 10 minutes. The pulps and juice are then forced through the colander, sieve or ricer to remove stems and seeds. The currant pulp and the blueberries are then mixed in the ratio mentioned and boiled moderately with occasional stirring until about one-half the free juice has been evaporated. Sugar is added at the rate of 1 pound per quart of blueberries for a tart jam or $1\frac{1}{4}$ pounds for a subacid jam. After adding the sugar the boiling should proceed at a rapid rate with almost constant stirring. When the syrup almost forms a jelly test the jam is finished. The hot jam is filled into clean, dry jars and processed for 2 or 3 minutes in the water bath.

Currant Jam

There are three types of currants: the red, white, and black. They are all handled in much the same manner except the black currants are sometimes blanched for a minute or two in hot water to remove a part of the very heavy aroma. The white currants will give a beautiful pink jam. The most serious objection to currant jam is the presence of the seeds. This may be ameliorated somewhat by manipulating the currants in such way as to make really a jelly with the fruit distributed evenly throughout it. The currants should be well ripened; if too green the flavor and taste will be impaired, but if too ripe the consistency will be syrupy or gummy.

The berries are washed, removed from the stems and placed in a suitable cooking vessel. One pint of water is added for each quart of berries. The kettle is covered and the fruit is cooked at moderate boiling for 10 minutes. Sugar in the ratio of 1 pound per quart is added and the cooking is continued in the open kettle at a rapid boiling. Occasional stirring is necessary to prevent sticking to bottom of the kettle. When the syrup sheets or flakes from the edge of the spoon the jam is finished. The jam is removed from the fire and allowed to cool for 3 to 5 minutes. This cooling is to prevent the pulps from rising to the top of the containers. When cooled it is stirred and poured into clean, dry glasses or into clean, dry jars. The glasses are

paraffined the following day. The jars are partially sealed and processed in the water bath for 2 or 3 minutes. If the pulps float to the tops of the glasses the jam was poured too hot. If the seeds are objectionable the pulps may be forced through a sieve or ricer just before the sugar is added. This will give a smooth, even-textured jam.

Grape Jam

The product described here is not strictly a jam but it fits into this group of products better than into any other.

The grapes should be well ripened. The berries are removed from the cluster, weighed, and are thoroughly washed. The skins are slipped from the pulps by pressing the berries between thumb and fingers. The skins are run through a food chopper, using the medium fine cutter. The chopped skins are placed in a suitable cooking vessel with ½ cup of water for each pound of fruit. They are boiled slowly in a covered vessel for 20 to 30 minutes. Water in the ratio of ¼ cup per pound of fruit is added to the pulp and they are cooked at slow boiling until they are thoroughly broken up. The pulps are then forced through a fine sieve or ricer to remove the seeds. The strained pulp and the cooked skins are mixed and boiled moderately until the liquid is reduced approximately one-half. Sugar in the ratio of ½ pound per pound of washed berries is added and the cooking proceeds at a rapid rate with frequent stirring until the hot material will sheet or flake from the edge of the spoon. The hot jam is filled into clean, dry jars, partially sealed and processed in the water bath for 2 or 3 minutes.

Gooseberry Jam

Gooseberries should not be used for jam until fairly well ripened. The blossoms and stems should be removed. These may be pinched off with the fingers or cut with a knife or scissors. If a uniform texture is desired the berries should be run through the food chopper, using the fine cutter. The prepared fruit is cooked at slow boiling in a covered kettle with ½ cup water per pound of fruit for 10 to 15 minutes or until the fruit is tender. Sugar in the ratio of ¾ pound per pound of fruit is added and cooking is carried on at rapid boiling with frequent stirring until the hot material will sheet or flake from the spoon. The hot jam is filled into clean, dry jars, partially sealed and processed for 2 or 3 minutes in the water bath.

Raspberry Jam

The three principal species of raspberries—red, black, and purple—are all used for making jam. There is a choice among the varieties of each of these species but since different varieties are grown in widely separated sections and since the same variety varies according to soil and climatic conditions no attempt will be made to list the varieties in order of their importance. However, the characteristics of species are more nearly constant and some mention of desirable or undesirable characteristics may well be made. The red raspberries produce the most attractive looking jam. The seeds are relatively small and are not as firm as in the other species. The black raspberries produce a black unattractive looking jam of wonderful flavor but very seedy. The seeds in the black raspberries are numerous and very large. The purple raspberries stand about midway between the red and black sorts. The seeds are medium in size and not quite as plentiful nor as hard as in the blacks. The flavor is more pronounced than in the red varieties though less than that of the black varieties.

The fruit is washed and drained well. A part or all of the berries are crushed and 1 cup water per quart of fruit is added. The materials are heated to the boiling point and moderate boiling is maintained until approximately one-half the free juice has been evaporated. Sugar in the ratio of $\frac{1}{2}$ to $\frac{3}{4}$ pound per quart of fruit is added and rapid boiling is continued with frequent stirring until the syrup will sheet or flake from the edge of the spoon. The hot jam is filled into clean, dry jars, partially sealed and processed for 2 or 3 minutes in the water bath.

The use of apple pulp as an extender discussed in "Grape-Apple Butter" (see page 114).

Raspberry jam may also be made by the sun-cooked method. Three-fourths pound sugar per quart of fruit is used and the method is the same as that given for sun-cooked strawberry jam.

Strawberry Jam

Two methods will be given for making strawberry jam. (*a*) The "kettle-cooked" method is a continuous-cooking process and enables the operator to finish the product within a short time. This, however, is done at some sacrifice of the aroma and flavor of the finished jam. (*b*) The "sun-cooked" method requires more time for completing the operation although at less expense of labor and fuel. The finished jam has more of the natural aroma and flavor of the fresh fruit with no foreign flavor.

Jam can be made from almost any variety of strawberry, but those varieties which are red throughout and which are sub-acid in taste are much better since the jam will be of better color and of higher quality.

(*a*) *Kettle-Cooked Strawberry Jam.*—The fruit should be fresh and well ripened. The large hollow fruits, the soft over-ripe berries and those that are of poor shape, even the "buttons," if not too bad will all work up well in jam.

The berries are first hulled, that is, the calyxes are removed. They are then thoroughly washed to remove all sand. In washing, one should lift the berries from the water and not drain the water from the berries. A part or all of the berries are crushed, and 1 cup water per quart of fruit is added.

Heat is applied slowly until the juice flows freely, after which the cooking proceeds at moderate boiling until the volume of the juice is reduced about one-half. The ratio of sugar should vary according to acidity of the fruit. One-half pound per quart for mildly sub-acid berries or $\frac{3}{4}$ pound per quart for the more acid fruits. After the sugar is added the cooking should proceed rapidly with frequent stirring until the hot syrup will sheet or flake from the edge of the spoon. The hot jam is allowed to cool for 3 to 5 minutes. During the cooling it should be stirred at frequent intervals to hasten solution of froth or foam. The jam is filled into clean, dry jars, partly sealed and processed for 2 or 3 minutes in the water bath.

NOTE.—If a jam of rough texture is desired add half the sugar at the beginning of the cooking period. The toughening effect of the sugar together with the careful stirring will enable one to produce jams of very uneven texture.

(*b*) *Sun-Cooked Strawberry Jam.*—The berries are selected and prepared as directed under method (*a*). The prepared berries are weighed and for each pound 10 to 12 ounces of sugar are allowed. The berries are crushed as much as desired; that is, for even texture crush thoroughly, for uneven or rough texture crush half or two-thirds of the berries. The crushed fruit is placed in shallow enameled pans usually about two or three pounds per pan. The sugar is added and thoroughly mixed with the fruit. The pans may be set aside for a few hours until the juice starts to flow from the fruit or they may be set over a slow fire and heated gently with constant stirring until the juice flows freely. The heat is then increased until the contents of the pan is boiling. The fruit is boiling throughout the pan when the ebullition of the juice and pulp continue while being stirred. When this point is reached the boiling is continued for 1 to $1\frac{1}{2}$ minutes with constant stirring. As the material cools it should be frequently stirred in order to dissolve the froth and foam. The froth is the coagulated albuminous material

in the fruit and it will be dissolved at temperature ranging from 140° to 180° if frequently stirred. When the material is clear and sparkling the pans are placed in the "Sun Cooker" or they may be set in a sunny window. When the jam has become quite thick, with little or no free liquid it is finished. (It requires 2 to 4 days.) The jam is filled and processed same as given under method (*a*).

Strawberry-Rhubarb Jam

Strawberries and rhubarb may be blended in almost any ratio, depending upon one's taste. A satisfactory blend is made by using 1 pound of rhubarb with 1 quart of berries. The calyxes are removed from the berries and then they are thoroughly washed. The rhubarb is trimmed; that is, the hard portion at the base and the branched part at leaf end are cut off. The rhubarb is washed and cut into half-inch lengths. One cup water is added to the rhubarb. The mixture is cooked at slow boiling until about half the free liquid has evaporated. The sugar in the ratio of 1½ pounds per quart of strawberries and pound of rhubarb is added and the cooking continued at a rapid rate until the pulp sheets or flakes from the spoon. The jam is cooled for 3 to 5 minutes with occasional stirring. When froth has disappeared the jam is filled into clean, dry jars, partially sealed and pasteurized at 180° F. for 10 to 15 minutes.

Strawberry-Pineapple Jam

Pineapple used in small amounts blends with strawberries to produce a jam of exceptional flavor. Pineapple should be at the rate of 4 to 6 ounces of prepared fruit for each quart of berries. The pineapple may be cut into very small pieces, grated or run through the fine cutter of a food chopper. This prepared fruit should be cooked in water until tender. One cup of water for 4 ounces of fruit if cooked at slow boiling in a covered vessel will be sufficient. The crushed berries are added and the cooking continued until about one-half of the juice has evaporated. Sugar in the ratio of ¾ pound per quart of strawberries is added and the cooking is continued at rapid boiling with frequent stirring until the jam will sheet or flake from the spoon. The jam is cooled for 3 to 5 minutes with frequent stirring. When the froth has dissolved the jam is filled into clean, dry jars, partially sealed and pasteurized at 180° F. for 10 to 15 minutes.

REFERENCES

See Chapter X, Fruit Products.

CHAPTER XIV

JELLY MAKING

Jelly is the product which results from cooking a proper fruit juice with sugar (except cider jelly) to such a point of concentration that it congeals or sets upon cooling. The texture of jelly is ultramicroscopic. Jelly is free from precipitates and suspended matter. Its consistency should be such that it is tender, easily cut, leaving clear, shining faces and sharp angles. It should spread easily, retain its shape when removed from the glass and should quiver. not shake, when disturbed. The taste should be sub-acid to tart with a flavor characteristic of the fruit.

ESSENTIAL MATERIALS

A proper fruit juice is one that contains at least the minimum amounts of pectin and acid. These, together with sugar, are the essential materials in securing the jelly consistency. A lack of any one of these will cause failure. To these essential materials must be added color and flavor as most desirable and necessary if an attractive and palatable jelly is to be made.

Pectin.—Pectin is the actual jellifying substance. It is a colloid, soluble in water but insoluble in alcohol. Heated in the presence of acid it slowly hydrolizes into pectic acid. It occurs in the cell walls of the fruit and is readily dissolved in water by the action of heat. The function of pectin in jelly making is to hold the sugars, other solids and some water in a sort of clot or net. If the sugar is in excess naturally the clot or net is distended and thereby weakend and the jelly will be soft or syrupy. But if the sugar is in too small amount the clot or net becomes more dense and the jelly is firm, tough, or rubber-like, depending on the relative amounts of sugar and pectin. There is then a reciprocal balance between the sugar and the pectin, but fortunately for the practical jelly maker this balance has a fairly wide range.

Test for Pectin.—Pectin being insoluble in alcohol, it is relatively easy to test for its presence in a fruit juice. If equal amounts of fruit juice and alcohol are gently mixed, any pectin present will be precipitated, usually as a clear gelatinous mass. If the amount is small or if

it is not good jellifying pectin it will show as a flocculent precipitate scattered throughout the liquid but will not at once, if at all, form into a distinct mass. Experience is necessary for one to estimate the probabilities of getting jelly from a juice so tested. But as long as the jelly maker confines his efforts to those fruits known to contain pectin in abundance there will be no need for making the test. The experimenter and the instructor will, however, find use for such tests.

Jelly makers are beginning to realize that not all pectins will make jelly, and the scientific literature now speaks of jellifying pectins and non-jellifying pectins.

Acid.—Acid is found in most fruits in sufficient quantity for jelly making. The two most notable exceptions are pears and sweet apples. Acids exist in many different forms in the various fruits. The more common ones are malic acid in apples and crabapples; citric acid in oranges, lemons, grape fruit, and currants; tartaric acid in grapes, and benzoic acid in cranberries. All of these acids may be utilized by the jelly maker.

Recent investigations have shown that the active acidity or hydrogen-ion concentration is of far more significance than the total acidity of the juice. This discovery may prove of great value to the large commercial jelly manufacturer who is equipped to make the proper tests of his fruit juices and who has at hand the means necessary to adjust the hydrogen-ion concentration to the optimum value required for best jelly consistency. The home and small factory jelly makers, however, must, continue, as a rule, to depend upon the fruits to supply the proper acidity for practical jelly making. They must rely upon recommendations or upon the taste. As a rule any fruit juice having a distinct sub-acid to tart taste will contain active acid or hydrogen-ion concentration suitable for jelly making. Fruits whose juice lacks necessary acid may be blended with the juice from those having an abundance of acid, or sufficient citric or tartaric acid may be added.

THE FRUIT

A good jelly fruit contains a sufficient amount of both pectin and acid. Fruits which lack either of these will yield jelly only when the juice is combined with a fruit juice especially rich in that particular material, or by adding the material itself. As a general thing the blend is preferred.

There has been much misunderstanding regarding the condition of fruit from which jelly is to be made. Most of the writers recommend the use of rare-ripe fruit. This recommendation is no doubt based

upon early chemical analyses of fruits which show that the pectin content of a fruit is highest just before it is fully matured. And since the older writers based jelly making on the amount of pectin present it seems natural that they should recommend the use of rare-ripe fruit. These writers, however, overlooked two very important facts: (1) Practically every fruit from which jelly is commonly made contains sufficient pectin to make good jellies when fully ripe, and (2) unripe fruits lack quality and no jelly maker can produce jellies with the natural aroma and flavor of fruits if these qualities are lacking in the fruits. Ripe fruits have developed their characteristic taste and flavor and they are not only more economical to use for jelly but they will also produce jellies of highest quality. Over-ripe fruits are unsuited to jelly making because as the fruits continue to ripen and become mellow or soft the pectin begins to break down. Such fruits may be used only in combination with other fruits rich in both pectin and acid, or by addition of home-made pectin solution or some commercial pectin.

Classes of Fruits.—The jelly maker divides fruits into three general classes: I—Those from which jelly may be made with ease. This group includes practically all apples except the sweet varieties, all crab-apples, blueberries, currants, most varieties of native grapes, all varieties of sub-acid and acid plums, quinces, and raspberries. II—Those from which jelly may be made only with difficulty. This group includes blackberries, cranberries, strawberries. III—Those from which jelly cannot be made, except by special processes. The fruits in this group lack either acid or pectin and if jelly is to be made this deficiency must be supplied. This group includes cherries, elderberries, peaches, and pears.

JELLY MAKING OPERATIONS

Jelly making naturally consists of two distinct operations: (1) Extracting the juice from the fruit, and (2) converting the juice into jelly. In any practical method of jelly making these two operations bear a very close relation to each other and any considerable variation in one would of necessity require compensating adjustment in the other.

1. Extracting the Juice.—Fruits contain in their pulp, juice, and skins the acids, pectin, sugar, flavor, aroma, and color which the jelly maker desires. Experience has shown that the maximum amount of the above materials is obtained by cooking the fruit in water. Furthermore, it is known that most fruits will yield only about one-half their jelly making materials in a single cooking. It is therefore becoming a general practice to make two cookings of practically all fruits in order to realize the greater jelly value from them.

Cooking the Fruit.—The fundamental things to be accomplished in cooking the fruit are a softening or breaking down of the tissues to set free the materials desired and a rapid solution of them in the hot water and fruit juice. It is not necessary to cook the fruit to a fine pulp but only until thoroughly tender and partially broken up. The length of the cooking period varies according to character of the fruit. Soft fruits will require 5 to 10 minutes, whereas hard fruits as apples, 15 to 20 minutes. Quinces may be cooked up to 30 minutes. Excessive cooking is to be avoided since it does not effect additional solution of jelly materials and it does tend to break down the pectin.

Rate of Cooking.—The cooking should proceed at a slow to moderate boiling in a covered vessel. The cover will insure uniform cooking of all the fruit and it also prevents excessive loss of water due to evaporation. A short standing period after cooking is highly desirable with colored fruits since more of the color bodies are set free and the finished jellies will be of best color.

Ratio of Water to Fruit.—The amount of water added to the fruit when extracting jelly stock together with the length of cooking will influence in a large measure the amount of jelly making materials obtained from the fruit and this in turn will determine the yield and quality of the jelly. Years of laboratory experience corroborated by recent investigations show that the general rule of 1 pint of water for each pound of hard fruits, such as apples, crabapples, and plums and 1 pint of water for each quart (approximately $1\frac{1}{4}$ pounds) of soft fruits such as berries and currants give most satisfactory results. All fruits are given two cooking or extraction processes, with the above ratio of water added for each cooking. It must not be assumed that an increased ratio of water with one longer cooking will give the same results as obtained from two cookings. The ratio of water recommended above applies only when fruit is handled in relatively small lots of a few pounds or quarts, such as is customary in the home or laboratory. If 10 pounds or more of fruit are cooked at a time the amount of water should be reduced somewhat.

Straining the Juice.—In straining the juice from the pulps a single layer of good grade cheesecloth should be used. The cloth is spread over the vessel that is to receive the juice. The hot juice and pulps are poured into it and the ends of the cloth are gathered up in the hands in such a way as to form a hammock. By alternately lifting and lowering one of the hands, the pulps may be moved from one part of the hammock to another, straining out the free-run juice very quickly. After the final cooking has been made the pulps are subjected to pressure in order to obtain all the juice. This pressing may be effected in vari-

ous ways. If fairly large amounts of fruit are being handled some sort of fruit press may be used. Smaller amounts of fruit may be twisted in the straining cloth by twisting in one direction with one hand and in the opposite direction with the other, or the juice may be forced out through the cloth by pressing with spoon or paddle.

Fig. 32.—Straining the juice from the pulps. The cheese cloth is formed into a hammock instead of a bag.

Clarifying the Juice.—The juice obtained by pressing is mixed with the two extracts and the entire lot is clarified by allowing the juice to flow through four layers of cheesecloth. This is most easily done by placing a colander or sieve over a suitable kettle and spreading the folded cheesecloth over the colander. The cheesecloth must not be pressed because fine particles of pulp would be forced through and the juice would be unfit for best quality jelly. Most juices are much more easily clarified if they are hot. The normal yield of clarified juice is approximately 1 quart for each pound of fruit. If reasonably large amounts of juice are being handled a felt filter bag is recommended to use instead of the cheesecloth for clarifying juices.

Basis for Sugar Ratio.—The clarified juice has long been the basis for estimating the amount of concentration and also the ratio of sugar to be added. It is, however, a better practice to substitute a given quantity of fruit for a measured amount of clarified juice for this basis, since by doing so more uniform jellies may be made. The pound of fruit is a constant in its jelly making content, whereas the amount of juice obtained from a pound of fruit may be quite variable. It is safe, then, to assume—if one follows carefully a standard method of extracting jelly stock from fruit—that the amount of jelly making materials obtained from a pound of fruit, over a large number of trials, will be fairly constant. The yield of juice, however, may vary from 24 to 36 ounces per pound of fruit. But this difference is practically always due to a slight difference in rate of cooking, length of cooking period, or to type of equipment. The yield of 24 ounces of juice indicates

therefore only a more concentrated juice which contains approximately the same amount of jelly making materials as does the 36 ounces. This being true it naturally follows that each of these two lots of juice should receive the same amount of sugar if the resulting jellies are to be uniform in taste and flavor. It is therefore a more logical practice for the careful jelly maker to use the pound of fruit as the basis for concentration and for computing the sugar ratio.

FIG. 33.—The pulps should be pressed to obtain all the jelly stock.

2. Converting the Juice into Jelly. *Concentration of Juice.*—The first step in converting the juice into jelly is concentration by rapid boiling. The amount of concentration is determined by (1) the yield of juice per pound of fruit, and (2) the ratio of sugar that is to be added. Experience has shown that the color, consistency, and flavor of jellies is best when the cooking period, after the sugar is added, is relatively a short one. And because jelly forms when the sugar concentration approximates 66 per cent of the finished jelly the concentration of the juice is a very important part in the operation. Because the composition of juices varies somewhat it is not possible to state just when, in the process of concentration, is the ideal time for adding the sugar, but for the amounts of sugar recommended good results will be obtained if the juice is concentrated approximately one-half before adding the sugar; or if the fruit is taken as a basis upon which to ratio the sugar, it is concentrated to 1 pint per pound of fruit.

The Sugar Ratio.—The amount of sugar to use per quart of fruit juice or per pound of fruit is not a fixed quantity. It may vary within rather wide limits. The chief factors which determine the ratio of sugar are: (1) the acidity of the fruit, (2) the taste of the consumer. Highest quality jellies are those which have a pleasant sub-acid taste and the aim of the jelly maker should be to so ratio the sugar and fruit that the finished jelly will have that desirable sub-acid taste and a distinctive fruit flavor.

A good general rule is to keep the ratio somewhere between one-fourth to two-thirds the amount of extracted juice. (Or ½ to 1¼ pounds per pound of fruit.) For example, mild sub-acid apples, like Baldwins, will require a low ratio, whereas a keen acid apple, like King David, will call for a medium ratio; or currants will require a maximum ratio. No fixed general rule can be laid down. Although the ratio of sugar added may vary considerably the percentage of sugar in a finished jelly of good consistency is fairly constant, that is, the sugar content will approximate about 66 per cent of the weight of the finished jelly.

The Jelly Test.—Many tests to determine the finish point of jelly are advocated. However, only two are here recommended. (1) The spoon test is quickly made and with a little experience is reliable. Testing should begin shortly after the sugar is added, but not until the juice has boiled up well in the kettle. It should be repeated at short intervals until the test has been shown at least two or three times. It is made as follows: The spoon, preferably a metal one with smooth, clean edges, is lifted full from the boiling syrup and held about a foot above the kettle. As the contents are poured back into the kettle the behavior of the last portion of the juice will indicate the condition of the syrup. At first it may pour like water, the final drops forming one tiny stream. Later two streams or drops will appear. As the cooking continues these last two or more drops will flatten out into a thin sheet which as the jelly reaches the finishing point will shear away from the edge of the spoon, leaving it clean. This shearing away of the sheet from the edge of the spoon is known as the sheet test or spoon test for jelly. (2) If a thermometer having a fixed scale is placed in the kettle of boiling syrup after the sugar is added it will show a continually rising temperature. At the same time the spoon test is applied the temperature of the finished jelly can be noted. This temperature will vary with different fruits and with different ratios of sugar. The range is 219.5° F. to about 223° F. at or near sea level. Once the temperature of a finished jelly has been determined it may be used as the finish point of all subsequent jelly made from that fruit. With a different fruit a new temperature must be determined. The jelly maker who does not manufacture jelly in large quantities will find the spoon test most satisfactory.

The experienced jelly maker soon learns to judge the condition of the boiling syrup by the manner in which it boils. If the surface of the boiling syrup is composed of fairly uniform small bubbles so that the whole surface is a fairly smooth dome shape it is merely a medium syrup. Later on the bubbles become less uniform and the surface less regular. As the material nears the jelly point the whole surface becomes

uneven. There will be light-colored hills and dark-shaded valleys, the bubbles are quite large and the steam escapes with an audible sound, so that one might say he "hears it boiling." The jelly test should be applied frequently after the surface begins to lose its smooth dome shape. The above presupposes that the heat is sufficient to cause the jelly to boil up almost to the top of the kettle.

Pouring the Jelly.—No time must be lost after the jelly test has been obtained. The boiling-hot jelly is poured through a single layer of cheesecloth which has previously been spread over a suitable utensil. The edges of the cloth are gathered up and the cloth lifted so that the jelly may quickly flow through. This straining is to remove any scales of scum which may have become loosened from the sides of the kettle. The jelly is then quickly transferred to the glasses which should be clean and dry and which stand on wood or on a cloth.

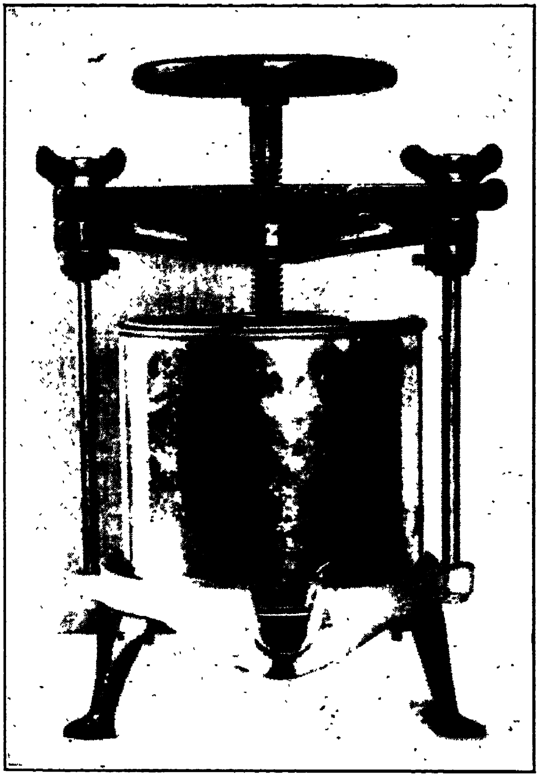

FIG. 34.—The small screw press is an efficient means for securing a maximum yield of jelly stock from the cooked fruit.

The glasses should be filled to within $\frac{1}{4}$ inch of the top. After standing for some minutes any bubbles that form on the surface of the glasses may be removed with a small spoon. The jelly should then remain undisturbed until it has set. This will require from a few hours to a day or more. Uncovered glasses of jelly should not be permitted to stand for many days in an ordinary room; under such conditions evaporation takes place from the surface of the jelly leaving a crust of sugar crystals.

The Paraffin Cap.—As soon as the jelly has set, it should be paraffined, sealed and stored in a cool, dry place. A teapot makes a handy utensil for melting and pouring paraffin. The paraffin should be hot and only

just enough to cover the jelly should be poured into each glass. When the paraffin has cooled the metal caps are applied and the jelly is stored.

The function of the paraffin is to exclude the air from the surface of the jelly, not to function as a hermetic seal. The exclusion of air

FIG. 35.—A teapot makes an excellent paraffin pot.

from the surface of the jelly inhibits the growth of molds and retards or prevents evaporation.

PROBLEMS RELATED TO JELLY MAKING

1. Failure of Jellies to Set.—(*a*) *Poor juice,* that is, juice lacking in acid or pectin or both. This may be due to too short cooking in extracting the juice or to the use of over-ripe or stale fruit or to fruit lacking one of the essentials of jelly making—acid and pectin.

(*b*) *Too large a ratio of sugar.* The pectin present in a fruit juice is capable of holding a definite maximum amount of sugar in a jelly consistency. If this amount is exceeded the pectin breaks down and a syrup results; may sometimes be corrected by re-cooking with an equal volume of fresh juice.

(*c*) *Not cooked to the finish point.* Jelly forms only when the concentration of the syrup reaches a definite point. If the cooking is stopped before reaching this point a thin syrup is the result.

(*d*) *Cooking beyond the finish point.* When jellies are cooked beyond the finish point the pectin breaks down and a heavy, ropy syrup or a wax is produced.

(*e*) *Long slow cooking.*—Pectin undergoes decomposition when boiled in the presence of acids. Long slow boiling of jellies is a bad practice since the pectin does break down and the jelly may fail to set.

2. Cloudy, Foggy Jellies.—(*a*) *Juice not properly clarified before making into jelly.*

(*b*) *Cooked slightly beyond the finish point*—verging to a sticky, gummy jelly, it will not clear after pouring because of its viscosity.

(*c*) *Improper manipulation of finished jelly.* If the jelly is allowed to cool too much before pouring it becomes viscous—sometimes lumpy; such jelly is almost always cloudy.

(*d*) *Pouring into glasses from too great height.* The spout of the pouring vessel should never be more than an inch or two above the top of the jelly glass. When poured from a distance of several inches above the glasses relatively large quantities of air are carried into the the jelly, forming bubbles which escape with difficulty if the jelly is well made.

(*e*) *Use of immature fruits.* Green fruits contain starch, which, being insoluble, gives the jelly a cloudy or foggy appearance.

(*f*) *Excess pectin.* If pectin is present in large amounts some of it may be precipitated, giving a cloudy jelly.

3. Sugar Crystals.—Either an excess of sugar has been used or the juice was too highly concentrated before the proper ratio of sugar was added. In making jelly from sub-acid fruits there should be a few minutes' boiling after the sugar is added; otherwise some of the sugar will crystallize.

4. Weeping Jelly Glasses.—The scientists have given the name syneresis to those changes which take place in stored jellies whereby a quantity of liquid separates from the jelly. When this liquid escapes from underneath the cover and flows down the outside of the glass it is called a "weeping jelly." The reason for the separation of the liquid is related to the acidity of the juice, which is greater in jellies made from the more acid fruits; also it is more noticeable in tender jellies than in the firmer ones.

The explanation of weeping lies in the fact that such glasses have been filled too full or the paraffin cap is too thick. If an eighth inch of clean glass is left above the surface of the paraffin there will be little trouble from weeping jelly glasses. Jellies cooked to a little firmer consistency will give less trouble from weeping.

5. Fermented Jellies.—In theory and according to our latest research data, syrups will not set to form true jellies until their sugar content is such as to prevent all ordinary forms of fermentation. Yet one often hears of fermented jellies. At the present time there are two possible explanations of this: (1) The so-called fermented jelly which is found to be somewhat liquid was, in all probability, never a true jelly; it was at the time of making a very tender jelly which through syneresis later became almost liquid and naturally fermented. (2) The jelly set at the time of making. Later, due to syneresis, a small quantity of

liquid formed around the solid jelly. This liquid fermented and gradually permeated the jelly giving it the characteristic fermented taste and flavor. The remedy in the first case is obvious, whereas in the second case there does not seem to be any practical method other than storing in a cool, dry place.

Amount of Juice to Cook at One Time.—The amount of juice, the character of the fire or heat, and the size of the kettle determine the length of the cooking period. With one exception (quince), all juices should be cooked to jelly as rapidly as possible. There is then a close relationship existing among the factors named above which combine to lengthen or shorten the cooking period.

With the average heating apparatus found in the home and in the small farm factory a 10- or 12-quart kettle is about the proper size to use. The maximum amount of juice that should be cooked in a kettle of this size is about 3 to 4 quarts. Where jelly is being made in large amounts the operator should be equipped with two or three kettles and by proper arrangement of the work there would be no long periods of waiting. When the jelly is finished in kettle number one the juice in kettle two has just had the sugar added, while kettle three has been boiling for a short time. By such an arrangement one worker can turn out many dozen glasses of jelly per day and none of it has been cooked for too long a time. With small amounts of juice the fires may be utilized to their full value, reducing the cooking period to a minimum, and producing jellies of fine color and exceptionally high quality.

RECIPES FOR JELLIES

In the recipes which follow, both methods of computing concentration and sugar ratio will be given insofar as practicable. This will allow the experienced jelly maker to continue using the juice as a basis if this method is preferred, or a change may be made to using the fruit as the proper unit if more uniform quality is desired. The beginner is strongly urged to follow carefully the methods of extracting the juice and to determine concentration and sugar ratio on the basis of the fruit.

In the manufacture of blended jellies it is generally more expedient to give the recipes on the basis of a measure of juice. This is done solely in the interest of clarity and simplicity of instructions. The experienced jelly-maker may apply the fruit basis here as well as in the single-fruit jellies.

Apple Jelly

Only acid and sub-acid varieties of apples should be used for making jelly. They should be ripe but firm. They need not be of good mar-

ket grade, in fact it is more economical to use those which, because of size and blemishes would not be sold as fresh fruit. As a general rule these culls will make as high quality jelly as would the better market grades.

The apples are first washed and the blossom and all decay are removed. They are then sliced across the core in fairly uniform slices about one-fourth inch thick. The slices are weighed, placed in a suitable sized kettle and an equal weight of water is added. The kettle is covered and set on the fire to cook. If scales are lacking the equal weights of apples and water may be approximated by pressing the apples down in the kettle until they are fairly firm, then adding water from a measuring cup until the apples just float.

Fig. 36.—Method of slicing apples for jelly making.

When the fruit comes to the boiling point the fire should be lowered so that boiling continues at a moderate rate until the fruit is soft—about 15 minutes. The free-run juice is strained off through a single layer of cheesecloth. The pulps are returned to the kettle and the same amount of water is added as used in the first cooking. During the second cooking occasional stirring is necessary to prevent scorching. The fruit should boil slowly for 15 minutes, after which it should stand for 10 minutes before straining. The juice is strained as in the first extraction and in addition the pulps are pressed or squeezed to obtain all the juice. The two extracts are mixed and clarified by straining through four layers of cheesecloth. There should be one quart of clarified juice for each pound of fruit cooked.

A measured amount of juice is placed in a suitable kettle and boiled rapidly until it is reduced to approximately one-half the volume of clarified juice (or to 1 pint per pound of fruit). The ratio of sugar will depend upon the acidity of the fruit. If mildly sub-acid the ratio will be 6 to 8 ounces, whereas the more acid varieties will require 12 to 16 ounces per quart of clarified juice (or per pound of fruit). The sugar is added when the juice reaches the proper concentration, stirring is necessary until the sugar dissolves. Rapid boiling should be maintained until the jelly test is observed.

The finished jelly is strained at once through a single layer of cheesecloth and is quickly transferred to clean, dry glasses, filling to within one-fourth inch of the top. After standing a few minutes the scum is removed and the jelly set aside to cool. When the jelly is firm the glasses are paraffined, covered, and stored.

Crabapple Jelly

Crabapple jelly is made in same manner as given for apple jelly. If the fruit is quite acid the sugar ratio should be increased by one-fourth to one-half pound.

Blackberry Jelly

All varieties of blackberries may be made into jelly if the berries are taken before they become soft-ripe. They should be well colored but firm. The flavor is considered by many to be too heavy and therefore combination jelly is preferred to unmixed blackberry jelly (see Combination Jellies, page 151).

The method of making blackberry jelly is identical with that of raspberry jelly to which the reader is referred for detailed instructions.

Blueberry Jelly

Blueberries make a very tender jelly of delicate flavor and fragrance. It is an excellent spoon jelly but not as well adapted to a spread as are the more acid jellies. The upland berries are somewhat lacking in acid and for that reason they are for most people's tastes better when combined with a tart fruit like currants or apple thinnings.

In making the jelly from blueberries the method is identical with that used in making raspberry jelly.

The combination jelly with currants would be made by combining equal portions of blueberry juice and currant juice. The procedure is the same as in making raspberry jelly. Three-fourths pound of sugar per quart of the mixed juices gives a mild, sub-acid, highly flavored jelly.

Currant Jelly

Jelly may be made from all species and varieties of currants. The red varieties are most commonly used and red currant jelly is what one thinks of when currant jelly is mentioned.

The fruit should be ripe and fresh. Fruit that has been picked for some days is likely to be deficient in pectin. The fruit is picked over

to remove all foreign matter and poor fruit, and it is then thoroughly washed and measured or weighed. The fruit is placed in a kettle and water equal to 1 pint per quart of fruit or $\frac{3}{4}$ pint per pound of fruit is added. The fruit is slowly boiled for 5 to 8 minutes or until the berries are soft. The free-run juice is strained off through a single layer of cheesecloth. The pulps are returned to the kettle and the same amount of water as was used in the first cooking is added. The fruit is allowed to boil slowly for 5 to 8 minutes, stirring occasionally and then is allowed to stand for 10 minutes. The juice is strained through one layer of cheesecloth. The pulps are squeezed or pressed at the close of the second extraction. The separate extracts are mixed and strained through four layers of cheesecloth. This juice is converted into jelly as follows: A measured amount of juice is placed in a suitable kettle and concentrated by rapid boiling to one-half the original volume (or to 1 pint per pound of fruit). Sugar equal to 1 pound per quart of extracted juice (or per pound of fruit) is then added and the juice is rapidly boiled to the jelly test. The finished jelly is strained through one layer of cheesecloth and quickly filled into clean, dry glasses.

Grape Jelly

Grapes should be well-colored but fairly firm for best consistency and flavor. Over-ripe fruits will give a syrupy jelly and under-ripe fruit will give a jelly of inferior flavor.

The grapes are picked from the clusters and washed. They are then weighed and placed in a suitable kettle and water equal to 1 cup per pound of fruit is added. They should boil slowly until the berries are quite tender but not pulped. The free-run juice is strained off through a single layer of cheesecloth. The pulps are returned to the kettle and twice as much water added as in the first extraction. They should boil slowly for 8 to 10 minutes. The kettle should be removed from the fire and allowed to stand for 10 minutes. The juice is strained off through a single layer of cheesecloth and the pulps are squeezed or pressed in order to obtain all the juice. The extracts are then mixed and strained through four layers of cheesecloth.

The juice is converted into jelly as follows: A measured amount of juice is poured into a suitable kettle and concentrated by rapid boiling to one-half the original volume. Sugar equal to $\frac{3}{4}$ pound per quart of extracted juice (or per pound of fruit) is added. (If grapes are quite acid a pound of sugar per quart of juice may be used.) Rapid boiling is continued until the jelly test is given. The finished jelly is strained through one layer of cheesecloth and is quickly poured into clean, dry

glasses. When the jelly has set, hot paraffin is added, the covers are adjusted and the jelly is stored.

Sometimes jelly makers are troubled by having the potassium bi-tartrate crystallize out in their grape jelly. This may be avoided by canning the grape juice in ordinary fruit jars and storing for a few months. During this time the crystals will form and settle to the bottom of the jars. The clear juice may then be drawn off and made into jelly. In canning the juice, clean glass jars are filled with the extracted juice, the jars are partially sealed and processed in the hot water bath—quarts 15 minutes, two quarts 20 minutes. The jars are then removed and sealed.

Another method of avoiding these crystals in the jelly and one that is adapted for home use is to make the first extraction as directed for grape juice (page 209) and to use only the second extract for jelly making. This jelly will not be of as high quality as that made from both extracts but it will be of good quality and rarely if ever will the crystals form in it. The first extract is bottled and used as grape juice.

Grape-Apple Jelly

Combination jelly is preferred by many and the apple is the best fruit to use in this case. The juices should be combined in the proportions of two of grape to one of apple or one of each will give a good grape-flavored product. Combination jelly is imperative if the grapes are over-ripe or even soft-ripe.

Plum Jelly

Jelly may be made from all of the native species and varieties of plums, from all of the Japanese varieties and from the more acid varieties of the Domestic or old English varieties. The red varieties naturally make the most attractive jellies, although some prefer the Damson or other blue plums. The method is the same with all varieties except that the ratio of sugar should be varied according to the acidity of the fruit.

The plums are weighed, washed, and cooked with an equal amount of water until tender. They should then be left for 10 minutes before the juice is strained through a single layer of cheesecloth. The pulps are cooked a second time in the same amount of water as used for first cooking until they are fairly well broken up and are again allowed to stand for 10 or 15 minutes. The juice is strained off and the pulps are thoroughly pressed or squeezed.

The two extracts are mixed and strained through four layers of

cheesecloth. The juice is measured and poured into a suitable kettle. The juice should be concentrated by rapid boiling to approximately one-half its original volume (or to 1 pint per pound of fruit), at which time sugar is added equal to $\frac{3}{4}$ to $1\frac{1}{4}$ pounds per quart of clarified juice (or $\frac{3}{4}$ to $1\frac{1}{4}$ pounds per pound of fruit), depending upon acidity of the fruit. The cooking should continue rapidly until the jelly test is given. The finished jelly should be strained through one layer of cheesecloth and filled at once into clean, dry glasses. When the jelly has set it should be paraffined, covered, and stored.

Quince jelly

In making quince jelly one must violate some of the primary laws which have been given to guide the manufacturer of fruit products.

With practically all the other fruit products rapid cooking and only a short cooking period should be adhered to, but in the case of the quince the long, slow cooking period is very desirable.

The fruit should be ripe but firm. It must be thoroughly washed and rubbed or brushed to remove the heavy coat of fuzz. The fruit is then cut into quarters and the core with the seeds and the gelatinous matter surrounding them is removed and discarded. The core if left in will make the jelly syrupy. The quarters are then cut into thin slices. The sliced quince is placed in the kettle and for each pound of fruit 2 pints of water are added. If tartartic acid is available one-fourth teaspoonful of finely powdered crystals to 3 or 4 pounds of fruit will greatly improve the jelly. The fruit is boiled slowly in a covered kettle for 30 minutes. The free-run juice is strained off and the pulps are recooked in covered kettle for 30 minutes with 2 pints of water per pound of fruit. The free-run juice is strained through one layer of cheesecloth and the pulps are pressed to secure all the juice. The extracts are mixed and clarified by straining through four layers of cheesecloth.

The clarified juice is placed in a kettle and $\frac{1}{4}$ pound of sugar per pound of fruit is added. The syrup is boiled slowly in an open kettle until a red color shows (20 to 30 minutes). The boiling is then increased until the volume is approximately 3 cups per pound of fruit, at which time sugar is added at the rate of $\frac{3}{4}$ to 1 pound per pound of fruit, depending upon acidity. Rapid boiling is continued until a well-defined jelly test is secured. The finished jelly is quickly strained through one layer of cheesecloth and poured into clean, dry glasses, filling them to within one-fourth inch of the top. When cold the paraffin is added, the covers adjusted, and the jelly is ready for storing.

A good tart apple juice (extracted as for apple jelly) may be combined with quince juice by using equal parts of each.

Raspberry Jelly

Jelly may be made from all varieties of the three leading sorts: black, purple and red. All of them produce jellies of exceptional quality. Raspberry jellies are aromatic and highly flavored. In fact the aroma and flavor are so pronounced in the pure jellies that many jelly makers prefer to combine them with juice of the apple, especially that of apple thinnings.

The jelly from the raspberries alone is made as follows: The fruit is washed, weighed or measured and to each quart of fruit 1 pint of water is added or to each pound ¾ pint of water. The fruit is boiled slowly for 5 minutes in covered kettle or until it is fairly well broken up. The juice is strained through a single layer of cheesecloth.

The pulps are returned to the kettle with water equal to that used in first cooking. The fruits are boiled slowly for 5 to 8 minutes and then allowed to stand for 5 minutes. The juice is strained through one layer of cheesecloth. The pulps are squeezed or pressed to secure all juice possible.

The separate extracts are mixed and strained through four layers of cheesecloth. The juice is converted into jelly by taking a measured amount of juice concentrating it to approximately one-half its original volume (or to 1 pint per pound of fruit), and adding ¾ pound of sugar per quart of clarified juice (or ¾ pound per pound of fruit). After the sugar is added the boiling is continued at a rapid rate until the jelly test is given. The finished jelly should be quickly strained through a single layer of cheesecloth and poured at once into clean, dry glasses. When the jelly is set the paraffin is added, the covers are adjusted, and the jelly is stored.

Strawberry Jelly

Strawberries, if not too ripe, will make excellent jelly. The dark-colored varieties having a distinct acid taste will give best quality. The berries should be hulled and thoroughly washed. The juice is extracted and the jelly is made in the same way as directed for raspberry jelly.

As a rule strawberry jelly is more satisfactory if made as a combination jelly, using fully ripened berries, for securing the juice. (See combination jellies.)

COMBINATION JELLIES

Combination jellies are made by mixing two or more fruit juices. The objectives in making these jellies may be: (1) to extend the color and flavor of an expensive fruit over a large volume; (2) to improve the quality of a jelly by distributing the rich aroma and flavor of a given amount of fruit over a relatively large volume of jelly; or (3) to correct some lack in a fruit juice by adding to it one especially rich in that particular element.

The apple is the most economical material from which to obtain the juice used in making these three types of jellies. As a general rule a juice without pronounced red color or distinctive flavor is preferred. However, in those combination jellies known as blends, a flavor in the apple juice is highly desirable and if the juice to be combined is entirely lacking color, as, for example, peach juice, a pink jelly may be made by using highly colored apple juice.

Apple Thinnings as a Source for Jelly

Apple thinnings are the small immature fruits, having a diameter of about one and one-half inches, which the fruit grower takes from the trees during the thinning season. As a rule the fruits are left in the orchard. Their utilization is of considerable economic importance. Some commercial factories use them in quantity and there is no reason why the home manufacturer should not make great use of this relatively cheap material.

These immature fruits contain an abundance of acid and when properly cooked will yield a juice rich in pectin. The juice has no distinctive flavor and if not cooked too long it is practically colorless, having a greenish-yellow tint. However, if cooked for some time it will develop a rather dark reddish-brown color.

Extracting the Juice.—The fruit is washed and cut into thin slices. One pint of water is added to each pound of prepared fruit. It is cooked in a covered kettle at moderate boiling for 20 minutes. The fruits are thoroughly stirred at close of cooking and allowed to stand 2 to 3 minutes. The free run juice is strained off through one layer of cheesecloth. The pulps are recooked for 20 minutes in a covered kettle with 1 pint of water per pound of fruit. After the second cooking the fruit is allowed to stand for 5 minutes. The juice is strained off and the pulps pressed to secure all juice possible. The extracts are mixed and clarified through four layers of cheesecloth. The yield of juice should be approximately one quart per pound of fruit.

The above juice contains sufficient acid and pectin to be used in combination with an equal amount of juice from such fruits as blackberries, cherries, peaches, pineapples, raspberries, strawberries, etc. It may also be used for making artificial jellies. It is not, however, quite as satisfactory for this latter type of jellies as juice extracted from more mature green or yellow varieties, such as Rhode Island Greening. Immature fruit contains much starch and this has a tendency to give delicately colored jellies a hazy or clouded appearance.

Apple thinnings do fit in well with the small fruits and cherries, because these fruits are in season at thinning time and usually there is no other readily available source of jelly base unless a supply of pectin solution (see page 153) was made the preceding fall or winter.

Making the Jelly.—In making combination jellies the juice is extracted from fruits according to directions given for that particular fruit or, if not given, the general rule for extracting jelly juice may be used. A measured amount of the desired fruit juice is mixed with an equal amount of juice from the apple thinnings or other apple juice. The mixture is concentrated to one-half volume by rapid boiling in an open kettle. When reduced one-half, sugar at the ratio of $\frac{3}{4}$ to 1 pound per quart of mixed juices is added and rapid boiling is maintained until the jelly test is given. The finished jelly is quickly strained through one layer of cheesecloth and poured at once into clean, dry glasses, filling them to within one-fourth inch of the top. When the jelly has set, the paraffin is added, covers are adjusted and the jelly is stored.

ARTIFICIAL JELLIES

In making artificially colored and flavored jellies the jelly maker has a choice of juice extracted from apple thinnings as given under combination jellies or of juice from matured green or yellow colored apples. As stated, the matured apples will give a jelly slightly more attractive because it does not contain an appreciable amount of starch. The juice from green colored apples is extracted in same manner as given for apple jelly.

Mint-Flavored Jelly

A measured amount of colorless or practically colorless apple juice is boiled rapidly in an open kettle until reduced to one-half original volume. Sugar at the rate of $\frac{3}{4}$ to 1 pound per quart of clarified juice is added. When the syrup boils vigorously, green color paste is added, a little at a time, until the desired shade of green is obtained. Rapid

boiling is continued until the jelly test. The finished jelly is quickly strained into a vessel to which 4 to 5 drops of extract of peppermint per quart of juice have been added. The jelly is quickly stirred and poured into clean, dry jelly glasses, filling them to within one-fourth inch of top.

If fresh peppermint is available it may be substituted for the extract. A growing tip with two or three leaves attached or two or three matured leaves are placed in each glass and the hot, strained jelly is poured over them. The leaves slowly rise to the top of the glass and may be removed or left on as preferred. If spearmint flavor is preferred it may be used instead of peppermint.

Stratified or Layered Jellies

Glasses may be filled partly full with the green mint jelly. After standing a few hours the glasses may be filled with a red jelly flavored with checkerberry or wintergreen. This latter jelly is made in the same manner as mint jelly except that red color paste is used and extract of wintergreen is added for flavor. Other combinations of colors and flavors to suit the individual taste may be made in the same manner.

Color

There are two kinds of color material available for coloring foods: (1) vegetable color, and (2) coal tar dyes.

Vegetable colors are unstable and, though admirably adapted to coloring candies, icings, that are for immediate consumption, they are not adapted to coloring jellies which are to be stored for some time.

The coal tar dyes are certified by the government. They are harmless to health. They have the advantage of being fairly permanent. No one need fear to purchase and use judiciously all coal tar dyes bearing a certified mark.

Pectin and Pectin Solutions

Two types of commercial pectins are now on the market. One of these is a liquid; the other a dry or powdered pectin. In addition to the pectin these substances also carry considerable acid so that they may be used to correct both acid and pectin deficiency in a fruit. The commercial manufacturers use these materials in the manufacture of both jams and jellies. The addition of pectin will greatly shorten the cooking period of a jam, giving a much more natural appearance of the fruit to the finished jam. In jelly making the pectin is used to correct

the lack of it in fruit juice but its greatest use is in the compound and artificial jellies. All such jams and jellies when offered for sale must state on their labels that pectin has been used.

The home jelly maker can manufacture a home-made pectin solution suitable for all ordinary purposes. The cost of this product will not exceed one-half that of the commercial brands available to the small jelly maker.

Cull apples may be purchased for only a few cents per bushel during the harvesting and packing season, and these are well adapted to the manufacture of pectin solution.

Method of Procedure.—The fruit is washed; and all rot, worms and scab are removed. The fruit is then sliced and the juice is extracted as given under apple jelly. The yield of juice should be approximately 1 quart per pound of fruit. The clarified juice is concentrated in small lots of 2 to 4 quarts each to about one-sixth or one-eighth of the original volume. This heavy, ropy syrup is strained while hot through a double fold of cheesecloth and is then filled into clean, dry jars or bottles.

The jars are partially sealed and processed in water bath for 2 or 3 minutes. The bottles are set into the water bath with water up to within one inch of their tops. They are boiled for 2 or 3 minutes, removed, capped or corked and laid on their side to cool.

This pectin solution will keep for months and may be used in combination jellies at the ratio of $\frac{1}{2}$ to $\frac{3}{4}$ cup per quart of the fruit juice. The mixture is brought to boiling for 2 or 3 minutes and sugar in ratio of 1 to $1\frac{1}{2}$ pounds per quart of fruit juice is added. Rapid boiling is given to the time of the jelly test. In making artificial jellies the pectin solution is diluted by adding one cup of the solution to three cups of water. The mixture is then brought to boiling, and sugar and flavor added as given under mint jelly.

Apple waste such as peels and cores or fresh pomace from the cider mill may be used as a source of materials for pectin solution. The peels and cores are manipulated in same way as given for whole fruit. Apple pomace will require more water—usually one pound of pomace will require approximately 4 to 5 pints of water for each cooking.

Neither of these waste materials will make as clear and clean-looking pectin solution as does the whole fruit. But if properly handled the product will be satisfactory, especially for blended jellies where the color is pronounced.

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CHAPTER XV

PRESERVES

Fruit preserves are whole fruits or pieces of large fruits preserved in a heavy syrup. They differ from canned fruits in both the amount of sugar required and in the method of manipulations. The fruit in a good preserve should be plump, tender, and the quality and flavor should not be masked by excess of sugar. Technically, a preserve should be in a syrup of not less than 60 to 65 per cent sugar but many fruits will make more satisfactory preserves if the syrup is approximately 50 per cent sugar.

PRINCIPLE OF MANUFACTURE

The making of fruit preserves depends upon the physical phenomenon known as osmosis, namely, that where two liquids, one or both of which carry some crystalline substance in solution, are separated by a suitable membrane there is a movement of liquids through this membrane which movement continues until both liquids have reached equilibrium, that is, they are both of the same density. The movement of liquid is always more rapid from the less dense to the denser liquid and the rate of movement is proportional to the differences in densities.

This principle of osmosis applies to the making of preserves in the following manner: The fruit to be preserved is properly prepared and is then placed in a sugar syrup whose density is somewhat greater than that of the fruit juice. Two effects will be noticed: (1) the fruit, especially if soft, becomes somewhat shrunken and flabby due to the more rapid flow of the less dense fruit juice through the cell walls into the denser syrup; (2) the syrup becomes less dense—less sweet as shown by both taste and by the saccharometer. However, in the course of a few hours the fruit will resume its normal plump condition. Examination will show that the fruit is sweeter and the syrup less sweet than when the process began. If this syrup has its density increased, either by addition of more sugar or by concentration of the syrup, and is then poured over the fruit the same changes as noted above will take place again. In this way by slow stages it is possible to produce fruit

preserves having a sugar content of 65 per cent or even more. If, however, at any stage of the process, especially at the beginning, the syrup is too dense, the flow of juice from the fruit may be so rapid as to rupture or collapse the cells in some fruits, notably, pears, apples and quince. Under these conditions osmosis will practically cease except that the dense syrup will "draw" the juice from the fruit, leaving it shriveled and tough.

Storing Preserves.—Preserves should be stored in small hermetically sealed jars, preferably half or quarter pints. They are so rich in sugar as to be eaten only sparingly and while they will keep in paraffined glasses provided the syrup is at least 65 per cent sugar, they are more satisfactory if they are made less sweet and are stored in sealed jars. Some preserves such as cherries and strawberries develop a large amount of froth in the jars if they are processed at boiling temperature. More satisfactory results may be had by processing these products at 180° to 190° F. for 10 minutes for half-pint size jars.

RECIPES FOR PRESERVES

Cantaloupe or Muskmelon Preserves

The melons should be ripe but firm. The rind is removed and the firm pulp is cut into pieces of desired size and shape. The prepared material is weighed and $\frac{3}{4}$ pound of sugar is allowed for each pound of melon. The melon and sugar are packed in alternate layers and allowed to stand for 24 hours. At the end of this period the juice from one small lemon per pound of melon is added and the materials are set over a slow fire. Slow boiling is maintained until the syrup sheets or flakes from the stirring spoon.

The hot preserve is filled into clean jars and is processed in the water bath for 2 or 3 minutes.

Cherry Preserves

Sour cherries are excellent for preserves. The pits should be carefully removed in order to retain the fruit whole. A thin hairpin, a loop of small wire or a wire paper clip may be used for effectively pitting the fruit. The syrup is made by allowing $\frac{3}{4}$ of sugar and $\frac{1}{3}$ cup of water per quart of cherries. When the sugar is dissolved in the water the pitted cherries are added and heated slowly with constant stirring to a simmer temperature for about one minute. As the fruit cools it should be stirred frequently to dissolve the froth and foam. The fruit is set aside preferably in a shallow pan in a sunny window for one day.

The pan of fruit is then heated slowly to boiling and boiled gently for one minute. The froth is again stirred in as it cools and the fruit is returned to the sunny window.

When the syrup becomes as heavy as desired and the cherries are plump they are packed into clean, dry jars and processed for one or two minutes in the water bath, or Pasteurized for 10 minutes at a temperature of 180° to 190° F. If cherries show a tendency to shrivel and become tough they were not cooked enough during the first cooking period. If they tend to break up they were cooked too much.

Cranberry Preserves

The cranberry preserve has a wider range of usefulness than any other preserve. It may be eaten as a preserve, substituted for maraschino cherries, used as a filler for bonbons or chocolate candies. They require a little more work but they are well worth the labor they demand.

The larger berries are more satisfactory. Each berry should be vented, that is, some small instrument like a toothpick, wire paper clip, or bodkin is thrust through the berry so as to pierce the cavity at the center of the fruit. This vent will permit the enclosed gas to escape during heating without bursting the fruit. There are two methods of procedure in preserving cranberries: (1) use of vacuum, and (2) heating.

Vacuum Method.—The vented berries are filled into one-quart or two-quart jars and covered with syrup made by dissolving one pound sugar in one quart water. The hot syrup is poured over the berries, filling the jars full. The jars are placed in a pressure cooker and heat is applied until steam escapes with a hissing sound from the petcock. The petcock is then closed and the fire removed from the cooker. The jars are allowed to remain in the cooker for several hours. When the jars are removed they are refilled with syrup and set aside for one or two days. The syrup is drained from the fruit and ½ pound of sugar per quart of syrup is added. The syrup is heated to boiling and poured over the fruit. Excess syrup should be saved in separate jars. Two days later this procedure is repeated. After two or three days the excess syrup is added to the drained syrup and the mixture is boiled down to just enough to fill the jar. The jar is sealed and stored. Preserves are ready for use within two to four days. They should be firm, plump and not over sweet.

Heating Method.—If a pressure cooker is not available the heating method must be used. There are several ways in which this may be accomplished but perhaps the simplest is as follows: The prepared berries are filled into the glass jars and the boiling syrup made as

directed above is poured over them. After one or two hours the syrup is drained off, heated to boiling and returned to the fruit. This operation should be repeated two or three times at intervals of one to two hours. The purpose of this initial process is to soften the berries without bursting them and to expel the gas from the fruit and replace it with syrup. Failure to cook the fruit sufficiently will result in a large per cent of "mummies"—dry, hard, shriveled berries.

After the syrup has been heated three or four times and poured over the fruit the process continues as directed under "Vacuum Method," beginning at the first operation after fruit is removed from the pressure cooker.

Steam Heating Method.—Another method is to place the prepared fruit in shallow pans and pour over the berries a hot syrup made as follows: For each quart of berries 1 pound of sugar is heated to solution in ½ cup of water. The berries and syrup are placed in a steamer and steamed for 30 to 45 minutes. After standing 2 or 3 days in a warm, dry room the preserves are ready to use.

Orange Preserves

Medium-sized seedless oranges are preferred. As a general rule the outer skin containing the oil sacs is removed by grating or paring with a sharp knife.

Three or four holes are then cut through the skin into the pulp of the orange. These holes are about ½ inch in diameter and should be evenly spaced around the middle of the fruit. The holes function as vents and prevent bursting of skin during cooking.

The prepared fruit is cooked in a syrup of 1 pound sugar per quart of water using enough syrup to float the fruit in the cooking vessel. The cooking should be at slow boiling in a covered vessel and just long enough to make the fruit tender. After standing a day or two the syrup is drained from the fruit and a half-pound of sugar per quart of syrup is added. This syrup, boiling hot, is poured over the fruit and allowed to stand for two or three days. If fruit is not sweet enough repeat the above process. A maraschino cherry or a preserved cranberry may be placed in each vent in the orange as they are packed into clean, dry jars and if desired the fruits may be covered with "grenadine" [1] syrup instead of the plain sugar syrup. The packed preserves are processed for 30 to 40 minutes in the water bath.

[1] The trade name of a syrup used for flavoring and preserving. It may be purchased at local stores.

Pear Preserves

The fruits should be hard-ripe. If soft they will go to pieces; if green they will lack quality. They are peeled and if large, like Bartlett or Bosc, they may be halved and cored or if desired they may be cut into smaller pieces. If small, like the Seckel pear, they may be left entire. As soon as peeled the fruit is placed in a weak brine (1 tablespoonful of salt per quart of water) until all the fruit is prepared.

The fruit is rinsed in clear water and is then boiled slowly in a very light syrup ($\frac{1}{2}$ cup sugar per quart water) until tender. This water is drained from the fruit and is made up to one pint for each pound of fruit by adding more water. Sugar is added at the rate of 8 ounces for each pound of fruit. Heat is applied to dissolve the sugar and the syrup is brought to the boiling point. The hot syrup is poured over the fruit and it is set aside for one or two days. The syrup is then drained from the fruit and 4 ounces of sugar per pound of fruit is added to the syrup, which is heated to boiling and again poured over the fruit. At the end of the second or third day the syrup is again drained from the fruit, measured and concentrated to two-thirds its volume by rapid boiling. After standing two or three days in this syrup the preserves should be about as sweet as desired and they are ready to be packed. If sweeter preserves are desired the syrup may be drained and concentrated to two-thirds its volume and poured over the fruit, which should stand two to four days before filling into containers.

When the preserves are as sweet as desired they are packed tightly into clean glass jars, the syrup is heated to boiling, and poured over the packed fruit filling the jars full. The jars are partially sealed and are processed in the water bath at boiling temperature for 2 or 3 minutes.

Peach Preserves

Peaches are peeled and may be preserved whole, in halves, or in slices. The method is identical with that given for pears.

Plum Preserves

Some varieties of plums make exceptionally well-flavored preserves. They should be sub-acid to tart and only firm-ripe. Only those varieties which have a fairly firm flesh are adapted to this method of making preserves. Burbank, most varieties of the Green Gage group and the Prune types of the European plums are all suitable for preserves.

The skins may be removed or not, according to taste. The quality is perhaps higher if the skins have been removed but the plums are

more difficult to handle; because there is greater danger that they will break up. If the fruit is ripe the skins may be readily stripped off of some varieties. Others will require blanching in boiling water (30 to 45 seconds) followed by cooling in cold water.

As a general rule the plums are pitted. This is relatively simple if the fruit is freestone. A cut is made around the fruit along the suture line. A slight twist separates the fruit into halves and the pit is easily removed. If the fruits are not freestone the flesh may be cut from the pit in almost perfect halves by using a knife with a curved blade similar to a grapefruit knife. The cut is made in the same plane as the suture line and as close to the pit as possible. When one half has been cut away the pit may be readily cut from the other half.

The prepared fruit should be placed in a salt solution (1 tablespoonful of salt per quart of water). A syrup is made by heating to solution equal parts of sugar and water. From ½ to ¾ pound of sugar per pound of fruit will generally be sufficient. The ratio of sugar will vary with the acid taste of the fruit. The fruit is removed from the salt solution, rinsed in clear water and placed in the syrup. Heat is applied to bring the syrup to the simmer or to approximately 200° F. for 2 or 3 minutes. The vessel is then set aside for 12 to 24 hours. It is then brought to boiling and boiled moderately, without stirring for 2 minutes. When cool the fruit and syrup are transferred to shallow pans and placed in the "sun cooker" (see page 164) or left in warm, dry room until the fruit is plump and the syrup has become almost jellylike.

Best results are had when the fruit is handled in small batches of not more than two or three pounds. An occasional stirring during the period of standing will hasten the process. The pans must not be covered.

The finished preserves are filled into dry jars partially sealed and processed in the water bath at 180° F. for 20 minutes.

Strawberry Preserves

The strawberry makes one of our most popular and delicious preserves. The fruits should be of medium size, well ripened and of a variety that is red throughout. Large, overgrown and soft berries should not be used for preserves. The best quality and appearance are secured by the sun-cooked method. Very excellent results, however, may be had if one does not have facilities for "sun-cooking."

The berries are hulled and washed in cold water. The fruit is weighed and placed in shallow enameled pans, allowing one to two pounds of fruit for each pan. Sugar at the rate of ¾ pound per pound of fruit

is spread evenly over the fruit. The pan is covered and set aside for several hours, usually overnight. During the standing period the sugar will cause some of the juice to flow out from the fruit and at the end of the standing period much of the sugar will be in solution. The pans are set over a slow fire and heated with just enough stirring to loosen the sugar from the bottom of the pan. When the sugar is all in solution more heat is applied. When the pan of syrup boils throughout while being gently stirred the fruit is said to be boiling. It is then boiled for one minute. The pan is removed from the fire and allowed to cool. If stirred occasionally while cooling the froth and foam will go into solution leaving the syrup and berries clear and sparkling.

The pans of berries are set in the sun cooker (see page 164) and left there with occasional stirring until the syrup is thick and the berries are plump. Or the pans may be set in a sunny window and stirred a few times each day for two to four days or until the syrup is of desired density. Preserves made in this way have the maximum aroma and flavor of fresh fruit. Their color is a bright, attractive red, while the fruits are large, plump and tender. The "sun cooker" saves some time and gives a little brighter color. If the berries shrivel or become tough it means that the initial cooking period was too short. Strawberries may be made into preserves by the same method as given for pears, but they will not as a rule be as satisfactory as the "sun cooked" preserves.

When the preserves are finished they are packed into clean dry, jars partially sealed and processed for one or two minutes in the water bath; or pasteurized at 180–190° F. for 10 minutes for half-pint jars.

Quince Preserves

The quince produces one of our most attractive and best flavored preserves. In order to secure the beautiful dark red color it is necessary to vary the general method somewhat, since the color is developed only through long cooking.

In preparing the quince care must be used to remove all the gritty material from around the core. The fruit may be left in halves or cut into thin slices.

The syrup is made by using 8 ounces of sugar and 1 quart of water for each pound of prepared fruit. The fruit is cooked in the syrup at slow boiling for one hour or until a decided red color has developed. After standing for 24 hours the syrup is drained from the fruit and 4 ounces of sugar per pound of fruit is added. The syrup is brought to the boiling point, and poured over the fruit. After one or two days

the fruit in the syrup is set over a slow fire and gently simmered or slowly boiled until color of desired density has developed. After standing two days the syrup is drained and boiled rapidly to jelly test. While the syrup is boiling the fruit is packed into clean, dry jars and the hot syrup, when finished, is poured over the fruit. The jars are partially sealed and processed in a water bath for two or three minutes. The preserves should be clear, tender, plump and of a deep red color. The syrup should set to form a soft jelly.

Tomato Preserves

The pear, plum or peach types of tomatoes are best suited for making preserves. Both the red and yellow tomatoes may be used. They may be made as pure tomato preserves or the flavor may be modified with a few thin slices of lemon. The tomatoes should be just ripe—neither green nor soft. They are blanched 15 to 30 seconds or just long enough to cause the skins to slip easily. When removed from the blanching water they must be cooled at once in cold water. The skins are removed but as a rule the core is not cut out as in canning. For each pound of prepared tomatoes 1 pound of sugar and ½ cup of water are required. The sugar is dissolved in the water and heated to boiling. The tomatoes are added to the boiling syrup and gently boiled until fruits are tender. They are then set aside for 24 hours. The syrup is drained and measured and is concentrated to two-thirds of the measured volume and poured while hot over the tomatoes. After standing 24 hours the syrup is again drained and concentrated until it will give a jelly test. The preserves are packed into clean, dry jars, filled with the hot syrup and processed for one or two minutes in the water bath.

Preserves may be made from the small varieties of tomatoes by using the sun-cooked method given for strawberry preserves. The tomatoes are blanched to remove the skins.

Watermelon Rind Preserve

The watermelon rind is cut into half-inch or inch strips and the peel and inner pink pulp are removed. These strips may then be cut into suitable size pieces, usually half-inch or inch squares. The prepared rind should be allowed to stand overnight in a weak brine (¼ cup salt per gallon of water). The next day the rind is freshened by standing for one hour each in two or three changes of clear water or by parboiling for two or three minutes in two changes of clear water.

The freshened rind is boiled in water (1 pint for each pound of rind) until tender. The water is drained from the rind, strained through cheesecloth and made up to 3 cups per pound of material by addition of water. One cup of sugar per pound of rind is added to the water and this syrup is brought to boiling and poured, while hot, over the cooked rind. After standing 24 hours the syrup is drained off and ½ cup sugar and the juice from one-half lemon are added for each pound of rind. The syrup is brought to boiling and returned to the preserve. After standing for two or three days the preserves are packed into clean, dry jars; the syrup is concentrated until it sheets from the spoon before filling into the jars. The packed preserves should be processed for one or two minutes in the water bath.

THE SUN COOKER

This device for finishing preserves consists essentially of a box with a sloping cover of glass. It may be attached to the south side of a building (see Chapter XXVII) or it may be set up in the yard. In the latter case it is supported above the ground on substantial legs. A band of cloth soaked in oil tied about each leg will discourage attack of ants and other creeping insects.

FIG. 37.—A sun cooker set up in the yard.

The cooker may be constructed as follows: Its length and width should correspond in size to any available window sash. The sides are nailed securely to the bottom. They should taper from ten or twelve inches at the back to five or six inches at the front. The back may be fastened to the bottom and sides or it may be hinged to the bottom so that it may be used as an opening into the cooker through which the products may be handled into and from the cooker. The greater part of the front should be left open for ventilation. The opening must be screened to exclude insects. The glazed window sash should fit closely over the top to form a tight cover. It may be held in place by screw eyes and hooks.

When set up for use the end designated as "front" above is placed toward the south. This position will allow the rays of the noon sun to fall almost perpendicularly upon the glass cover.

The sun cooker works upon the principle that solar energy readily passes through glass while heat energy escapes slowly through glass or wood. Therefore the result is the accumulation of heat within the cooker. On clear, summer days the temperature inside a well-constructed sun cooker may rise to 150 to 160° F. This high temperature causes a rapid concentration of the syrup in the pans of fruit within the cooker so that only a few days of clear weather are required to finish the preserves.

The operation of the cooker is very simple. The fruit after receiving its initial preparation is placed in shallow pans. The pans are placed in the cooker and left there until the syrup has become sufficiently concentrated and the fruit is quite plump. A thorough stirring of the fruit in the pans two or three times each day will not only hasten the process but will improve the quality of the preserves.

The finished preserves are filled into glass jars and processed in the water bath for 3 to 5 minutes.

REFERENCES

See Chapter X, Fruit Products.

CHAPTER XVI

CANDIED FRUITS AND FRUIT CANDIES

CANDIED FRUITS

A candied fruit is one which has been so thoroughly impregnated with sugar that when removed from the syrup and dried beyond the sticky condition it may be kept for months without deterioration. The fruits are plump, tender, exceedingly sweet and of high flavor.

Kinds of Fruits Candied.—Only the firm-fleshed fruits are suited to this process. Those most commonly candied are apricots, apples, cherries, citron melon, citron, cranberries, grape-fruit peel, lemon peel, orange peel, pears, peaches, pineapple, plums, and quince.

Many of these fruits may be used while fresh or canned fruits serve equally well. Canned apricots, peaches, pears, and pineapples are frequently substituted for the fresh fruit.

The manufacture of candied fruit differs from the methods used in making fruit preserves in the following respects: (1) The introduction of invert sugars to replace some of the cane sugar; (2) greater concentration of syrup, and (3) the removal of finished product from syrup with a few hours of drying to remove excess of syrup.

1. *Use of Invert Sugars.*—Invert sugars are necessary in making candied fruits. Otherwise the finished fruits will in the course of a few weeks form a heavy outer covering of crystallized sugar and the product will be unfit for ordinary uses. The commercial manufacturer uses glucose, cerulose or corn syrup. The home manufacturer must as a rule depend upon the frequent boiling of the syrup to give sufficient invert sugars to keep the product properly, or a small amount of corn syrup may be added. The objection to the first method is that one cannot be sure that the necessary amount of sugar has been inverted, and the second method is objectionable because the corn syrup in excess adds a flavor to the finished product. Of the two methods, however, the addition of corn syrup (if invert sugars are not available) is preferable.

2. *Syrup Concentration.*—Greater concentration of syrup is necessary to prevent undue shrinkage or shriveling of the fruit. Preserves may be finished in 40 to 60 per cent syrup. Candied fruits are seldom

finished in less than 65 and generally 70 per cent sugar content as tested by the Brix or Balling saccharometer.

3. *Drying of Product.*—When the process of sugar infiltration is completed the fruits are removed from the syrup, drained well and allowed to dry beyond the sticky stage. The fruits are then packed into containers and sealed or wrapped in waxed paper and packed in boxes, or the unwrapped fruit may be stored in dry glass fruit jars or friction top seal tin cans. If properly made no coating of sugar crystals will form on the fruits and they may be kept in a relatively dry storage for months.

Method of Procedure.—The manufacture of candied fruits is a rather exacting process, and although fair results are often had by rule of thumb methods, success is assured if one is properly equipped to do the work. The use of a saccharometer to determine the sugar density of the syrup throughout the various stages is almost necessary if one's work is to be uniform. The Balling saccharometer is recommended because a single instrument will give readings up to 70 per cent syrup.

The fruit is prepared as for making preserves. The syrup is made by using glucose or corn syrup one part and sugar two parts. This is mixed with enough water to make a 30 per cent syrup. One pound of glucose or 1 pint of corn syrup and 2 pounds of sugar will require about 3½ quarts of water to make a 30 per cent syrup. The syrup should be in sufficient amount to cover the fruit.

The prepared fruit is placed in the syrup, the vessel is covered and slow boiling is maintained until the fruit is tender. The fruit is then set aside for one or two days, during which time the sugar content of fruit and syrup is practically equalized. The syrup is drained from the fruit and tested. By reference to the syrup chart on page 78 the amount of sugar necessary to bring the syrup to 40 per cent may be readily computed. The added sugar is made up as before—glucose or corn syrup one part, sugar two parts. The new syrup is heated to boiling and returned to the fruit. If the fruit tends to float high enough in the syrup to expose much of the top pieces a woven wire screen with weights should be used to keep the fruit submerged. Two days are allowed the fruit to absorb the sugar, when the syrup is again drained and tested. It is made up to 50 per cent as directed for the 40 per cent. At the end of each succeeding two- or three-day period the density of the syrup is raised approximately 10 per cent. When the syrup remains constant around 65 to 70 per cent no further concentration is given.

As the process continues after addition of the second or third lot of sugar it will be found that the volume of syrup is much larger than necessary. Instead of adding more sugar the density may be increased

by concentrating the syrup by rapid boiling. The volume of syrup should not be allowed to increase much above what is just required to cover the fruit. Keeping the volume down to minimum requirements saves sugar and the volume of syrup left at close of operation will not be excessive. This left-over syrup may be diluted and utilized on a second batch of the same kind of fruit.

After the fruit has stood for several days in a 65 to 70 per cent syrup it is taken from the syrup, drained well, and given a quick rinse in cold water to remove excess of syrup on the surface. After draining off all water the fruit is spread on waxed paper on trays or frames and left in a dry room for a few days. When the surface loses its stickiness it is ready to store.

If canned fruit is used the initial cooking is omitted. The fruit is placed in the hot syrup, which should carry approximately 10 per cent more sugar than that in which it was canned. Otherwise the method of handling canned fruits is the same as given for fresh fruit.

NOTE.—A few fruits such as the peel of citrus fruits and citron melon undergo special treatment before being placed in the syrup. See directions for these materials.

SPECIAL RECIPES

Apricots.—If fresh fruit is used it should be ripe but firm. It should be blanched just sufficient to permit easy removal of the skins. The fruit is halved and pitted. It is then ready for the initial cooking. If canned fruit are used the peeled fruit is preferable. The general method just described is followed.

Apples.—The fruit is peeled, quartered and cored. If not too large the quarters are candied, if large they are cut into two slices. The less acid varieties will handle more satisfactorily. The acid sorts tend to become soft or fluffy and readily break down to sauce. The general method is applied to apples.

Cherries.—Most sour cherries are too soft and juicy. The sweet cherries are best for this product. The fruits are pitted and candied as given in the general method.

Citron Melon.—The melon is cut into inch slices. The green outer rind and the seed pulp are removed. The peeled melon is placed in a brine, made by dissolving one-half pound salt in one gallon of water. After standing 24 hours it is freshened by standing in several changes of water or by parboiling. The slices are cut into suitable-sized pieces, 2 or 3 inches in length and cooked in water at slow boiling, until tender. The subsequent treatment is the same as given in the general method.

Citrus Fruit Peel.—The peel of lemons, oranges, and grape-fruit may be candied for use in mincemeat and for confections. The peel in halves or in slices is prepared by removing all adhering " rag " or fibrous materials from the inner white coat. The outer skin is thoroughly washed, and scraped, if necessary, to remove traces of disease or insect injury. The prepared skins are placed in a brine (one-half pound salt per gallon of water) for 24 hours. The subsequent treatment is determined somewhat by the individual taste. The peel may be freshened in clear water and candied if excessive bitter taste is desired or a part of the bitter taste may be removed by parboiling two to four times, boiling each time for 5 to 10 minutes in enough water to cover. After parboiling the peel is cooked tender, drained and placed in 30 per cent hot syrup. The general method is applied from this point on to the finish. A little extra care will enable one to candy these peels in halves. Those of the grape-fruit especially are very attractive when filled with citrus marmalade or pieces of candied peel or mixed candied fruits.

Citron.—The fruit is cut into halves and allowed to ferment for 14 to 20 days in a weak brine (2 ounces salt per quart of water). After fermentation is completed the fruit is taken from the brine, the seeds are removed and discarded, the fruit is freshened by standing for a few hours each in several changes of water. It is then boiled in water until tender. It is candied as given in the general method.

Cranberries.—The method given for cranberry preserves is used for candied cranberries, except that the density of the final syrup is 65 to 70 per cent. The fruits are removed from this syrup after one week, rinsed and allowed to dry beyond the sticky stage. They may be stored in fruit jars, kept tightly sealed.

Pears.—The fruit should be ripe but firm. Large fruits are peeled, halved and cored. Small fruits are peeled. The general method is applied to pears.

Peaches.—The fruits must be ripe but firm. They are peeled with a knife, by blanching, or lyeing. (See peach preserves.) After peeling the fruit is halved and pitted. The general method is applied to peaches.

Pineapple.—If fresh fruit is used it is peeled (see page 74) and cut into disks about a half-inch thick. The core is removed and the fruit is ready to be candied. If canned fruit is used the sliced is preferable. The general method is used with pineapple.

FRUIT CANDIES

Many fruits lend themselves to the manufacture of a variety of candies and confections. The candied fruits make delicious fillers for bonbons and chocolates. The small fruit jams and marmalades may be cooked to such consistency that when moulded or cut into proper sizes they, too, are most desirable fillers. The juice from many of the fruits make excellent pulled candies or fondant and a few may be made into soft creams. All these fruit products carry their delicious flavor and aroma into the finished candies.

Some Chemistry of Candy Making.—There are two general types of sugars: (*a*) crystalline and (*b*) non-crystalline. Crystalline sugars tend to go back to their natural state, especially in saturated or supersaturated solutions. This is the cause of the graining effect of many candies. Preventive measures are: (1) To prevent the syrup from coming in contact with crystals as it cools; this may be accomplished by carefully wiping all crystals from the pouring side of the cooking vessel before pouring the syrup. (2) The addition of non-crystalline sugars to crystalline sugars prevents the formation of crystals in this way; the microscopic crystals are surrounded by a film of non-crystalline sugar, thereby preventing the formation of noticeable-sized crystals. (3) The addition of some acid in small amount brings about an inversion of some of the cane sugar and the same conditions, in some respects at least, prevail as when invert sugar is added. Cream of tartar is most commonly used for this purpose.

Inversion and Its Effects.—When a crystalline sugar is boiled in the presence of an acid, a part or all of it becomes inverted; that is, the molecule of cane sugar or sucrose is broken down into two molecules, one of dextrose and one of levulose. Excess inversion is to be avoided in making most candies, otherwise the finished candy is soft. Excess inversion may be due to addition of too much acid or to a long boiling period.

Most invert sugars and levulose in particular have a great affinity for water. These sugars absorb water from the surrounding moist air and become sticky and if carried to the extreme the candy may liquefy. This explains why hard candies become sticky during the damp summer weather and also why candied fruits to which invert sugars are added remain soft and plastic, while those to which no invert sugars have been added are crusted with sugar crystals and the fruit itself becomes granular.

Fondant.—Fondant is a mass of microscopic crystals each of which is enveloped within a film of invert sugar syrup. This structure tends

to prevent the formation of noticeable-size crystals and gives a soft, creamy, plastic mass. Both the consistency and texture are largely determined by the kind and amount of invert sugar present and by the finish temperature. The manipulation of the finished syrup is a final factor in determining consistency and texture. If the syrup is stirred while it is too hot (above 150° F.) the crystals will most likely be large enough to be perceptible, whereas if allowed to cool to 100° F. or below before stirring, a soft cream rather than a fondant will be the result. Fondants are of two general types.

(*a*) *Invert Sugar Fondant.*—This type of fondant is made by adding to the sucrose or cane sugar a sufficient amount of invert sugar, generally in the form of corn syrup or glucose, to give the required consistency. Fondant made in this way is likely to be dry and cheese-like rather than soft and creamy.

(*b*) *Acid Fondant.*—Fondant of this type is made by adding a small amount of acid to the cane sugar syrup. During the boiling period the acid will invert a sufficient amount of the cane sugar into glucose and levulose to give the required consistency. This kind of fondant is more difficult to make than invert sugar fondant because if either too little or too much acid is used failure is sure to be the result. Acid fondant is generally the more desirable type since it undergoes a secondary inversion a few days after making and instead of becoming dry and cheese-like it becomes more plastic and creamy. Cream of tartar is the most common form of acid used in making fondant. Other household acids such as vinegar or lemon juice may be used but these are less satisfactory than the cream of tartar.

Method of Manufacture.—For each three pounds of granulated sugar two and one-half cups water and one-half teaspoon cream of tartar are required. The sugar and water are mixed and brought to boiling. The cream of tartar is added and boiling at moderate to rapid rate is continued to 238° to 240° F. (26° to 28° F. above temperature of boiling water). The vessel is removed, all crystals are wiped from pouring side of vessel with a damp cloth and the syrup is poured into a flat pan to cool. A thermometer is inserted and the syrup is allowed to cool undisturbed to 110° to 120° F. It is then stirred or beaten until the batch is thoroughly creamed. If allowed to stand, the fondant may become hard. Therefore when stirring is finished the fondant is turned out upon a platter or board and kneaded with the hands until thoroughly plastic. The finished fondant may be used at once or it may be stored in a closely covered crock and kept for weeks. This fondant will undergo a second inversion within a day or two, becoming more plastic and creamy.

The common uses for fondant are: (1) *Fillers*. The fondant may be molded in the hands or cast in starch or rubber molds and used as centers or fillers for bonbons and chocolate candies. By use of colors, flavors, and perfumes an almost countless variety of fillers may be made. (2) *Coating*. Fondant forms the coating of all bonbons. Here also colors and flavors may be used to produce variety. Moist fillers are first given a fondant covering before dipping in chocolate. (3) *Creamed mints*. Fondant is colored, flavored, and moulded to produce the common cream mints. In home candy making they may be dropped from a spoon onto waxed paper or moulded in the hands into small balls and flattened by pressing them on waxed paper. If white spots form on dropped or moulded mints it is an indication that the fondant was too hot.

Cast Fillers.—Starch moulds for casting fondant or other candy fillers are made as follows. A shallow pan is filled loosely above the level with cornstarch. A straight-edge is drawn across the top of the pan, leaving it level full. A knife handle, large test tube or similar tool of the desired size is used to make the impressions in the starch. A little experience will enable any one to insert the tool into the starch to the proper depth and then withdraw it without marring the mould. These moulds or depressions are filled with the melted fondant which has been heated in a double boiler just to the liquefying point. When the moulds are all filled the pan is set aside for a few hours. The starch is separated from the cast fillers by sifting it through a fine sieve.

NOTE.—Fondants and other beaten candies should not be stirred with a metal spoon in aluminum or white enameled vessels. A good wooden spoon or paddle should be used or stirring should be done in colored enameled vessels.

Fruit Fondants.—Fruit fondants are made as described for plain fondant except that the juice of very mildly sub-acid fruits such as pear, peach, quince and raspberries is substituted for a part or all of the water. The fruit juice is extracted in the same manner as for making jelly. If the fruit is fairly acid some difficulty is experienced in stirring to a finish. This trouble may be largely overcome by omitting the cream of tartar. As a rule a fruit fondant which cannot be stirred to a finish will set into a fondant consistency if left overnight after thorough stirring.

Fruit fondants may be used in the same manner as plain fondant except that rarely if ever will color or flavor be added to them.

PULLED CANDIES

Pulled candies with the characteristic flavor of fruits may be made from many of the less acid fruits. Cranberry, currant and similar fruits offer more difficulties perhaps because of their high acidity. The juice is extracted in the same manner as when making jelly, and its conversion into pulled candy is essentially as follows:

The fruit juice is concentrated to one-half its volume. One cup of this concentrated juice, and $1\frac{1}{2}$ pounds of granulated sugar are placed in a sauce pan and brought to boiling. One-fourth teaspoonful of cream of tartar is added (if juice is tart omit cream of tartar) and boiling continues rapidly to about 230° to 240° F., then more slowly until the temperature is 258° to 260° F. (46° to 48° F. above temperature of boiling water). The kettle is removed from the fire, the crystals are wiped from the pouring side of the vessel with a damp cloth and the hot syrup is poured into a lightly buttered shallow pan or platter. When cool enough to handle it is taken into the hands and pulled until it becomes quite plastic. It is then pulled into a cylinder about one-half inch in diameter and cut into inch lengths with scissors. If the candy is sticky confectioner's sugar may be used to prevent pieces from sticking together. As a rule this candy should be wrapped in paraffined paper.

NOTE.—The addition of an ounce of butter to the boiling syrup a few minutes before removing from the fire will prevent sticking to the hands. If a very hard candy is desired the finish point may be carried to 270° or 280° F. (58° to 68° F. above temperature of boiling water).

FRUIT PASTES

This term has been given a wide application when applied to confections and candies. Some are made from pulps and are little more than heavy fruit butters, jams or marmalades. Others are made from either dried or candied fruits with or without the addition of fondant. Others still are made from fresh fruits cooked to a very heavy consistency in a sugar syrup.

Dried Fruit Paste.—Equal parts of three or more dried fruits, such as peaches, apricots, dates, prunes, figs, etc., are run through the food chopper using the peanut butter cutter. The fruits are reduced to a fine pulp. To these a few ounces of finely cut nut meats are added and the mixture thoroughly kneaded with plain fondant in ratio of 1 part paste to 2 or 3 parts fondant.

The resulting paste may be used as fillers. These are made as follows: a small lump of the paste is rolled on a cutting board to form

a cylinder about one-half inch in diameter. This is cut into half-inch lengths and the short pieces are lightly rolled in the palms to form small balls. These, placed on a waxed paper, are ready for dipping in melted fondant or chocolate, after standing for a few hours.

A small amount of the paste may be rolled out to form a thin sheet about one-fourth inch thick. Next a similar sheet of plain fondant is formed which is laid upon the paste sheet. A second paste sheet is made which is placed on the fondant sheet. These three sheets are lightly rolled to form a fairly solid mass, which may be cut into pieces of suitable size. After standing for a few hours they are ready to serve or to pack and store. Confectioner's sugar will prevent sticking to moulding board. Dried fruit pastes may be stored and kept indefinitely.

Marmalade Paste.—The citrus marmalade is most suitable and makes an excellent confection and equally good fillers. The marmalade (page 124) is placed in the vessel and heated slowly until boiling. It will require constant stirring. When the hot pulps come from the spoon in large sheets or flakes it is finished. If molds are convenient the hot marmalade may be filled into them and after a day or two they may be removed, or the marmalade may be poured into a shallow tray or candy pan to a depth of a half-inch. When cold the mass may be removed, dusted with confectioner's sugar and cut into suitable pieces for serving or for dipping. If moist when cut the pieces may be dusted with sugar or allowed to dry for a few hours before using. Fruit jam pastes may be made in the same way.

Fresh Fruit Paste.—Apples, peaches, and pears are best for this product. A syrup is made by boiling together sugar in the ratio of 1 pound to $\frac{1}{2}$ cup of water and $\frac{1}{4}$ teaspoonful cream of tartar to a temperature of 260° to 270° F. At this time $\frac{1}{2}$ pound of peeled and prepared fruit which has been run through a food chopper, using medium cutter, is added. The mixture is cooked, with enough stirring to prevent burning, to a temperature of 260° F. (48° F. above boiling temperature of water). The kettle is removed from the fire and one teaspoonful of gelatin which has been soaked for five minutes in five teaspoonfuls of water is stirred in. The finished paste is poured into a lightly buttered platter, forming a sheet about one-half inch thick. When cold the sheet is removed and cut into suitable pieces, using scissors. The pieces are dusted with confectioner's sugar and spread on a tray to harden. If soft they must be wrapped in waxed paper. This confection may be eaten out of hand or it may be used as filler for bonbons or chocolates.

BONBONS

A bonbon is a candy made by coating a filler or center with melted fondant. The center may be of fondant, colored, flavored, or scented, or it may be of fruit pastes, candied fruits, etc.

Dipping Bonbons.—The fondant used for coating bonbons is melted in a double boiler. The maximum amount of water is placed in the reservoir, the fondant is placed in the inner boiler which is covered, and the boiler is set over the fire to heat. Heat should be applied slowly. The fondant should be stirred occasionally to facilitate melting. Properly made fondant may be melted without heating the water in outer boiler to the boiling point. When the fondant becomes liquid the vessel is removed from the fire and dipping may begin. It is essentially as follows: The filler is dropped into the fondant, submerged, and is lifted out with a bonbon dipper or an ordinary 2-tined table fork, using the fork spoon fashion. The surplus is quickly drained and the bonbon is transferred to a waxed paper. A little practice will enable the operator to deposit the finished candy on the paper with just the proper amount of fondant to give a good finish. If a heavy base forms around the piece the fondant is too hot or the piece was not well drained. When the fondant becomes too cold for dipping it should be reheated. Hot fondant gives a very thin covering which may show many small white spots. Cold fondant tends to form a very heavy coat.

Bonbons harden quickly after dipping. They may be stored or served as soon as the coating has become firm. As a general rule bonbons do not store well, the coating tends to become dry and hard and the candy has all the appearances of stale goods.

CHOCOLATE CANDIES

An almost endless variety of candies may be made by dipping assorted fillers into melted chocolate.

The conditions for successful chocolate dipping are very exacting. The chocolate must not be heated to too high a temperature (90° F. is considered a maximum temperature); the room should be cooled to around 65° F., or if warmer than 60° to 65° F. only a few pieces may be dipped at a time and these should be placed in a cool dry place to harden. Moisture must not be allowed to come into contact with the chocolate; and all implements, such as thermometer, stirring spoon and dipping fork, as well as the fillers must be dry.

Preparing the Fillers.—Fillers or centers are prepared in many different ways. Fondant fillers are colored and flavored and formed by rolling small pieces lightly between the palms and placed on trays

to harden. Or the fondant may be melted in a double boiler and the fillers cast by placing the liquid fondant in rubber molds or in starch molds. Fruit pastes if firm enough may be cut to any desired size and shape. Candied fruits are cut to size and dipped in fondant before dipping in the chocolate. Caramel and other manufactured candies are cut to size and may be coated with chocolate or they may first be dipped in melted fondant. Preserved or spiced fruits are first given a coating of melted fondant. All fillers that have any moisture on their surface must first be coated with fondants. Otherwise the moisture on the fillers would spoil the chocolate.

Preparing the Chocolate.—Not less than a pound of good dipping chocolate should be used at one time and 2 to 3 pounds are more satisfactory. If dipping chocolate is not to be had at the stores the confectionery shops will be able to supply the home candy maker. The chocolate should be cut into thin shavings with a sharp knife. It is placed in the inner vessel of a double boiler. The outer vessel is filled with the maximum amount of water and heated to 110° to 120° F. The vessel containing the chocolate is set into the warm water and the chocolate is stirred constantly until it is all melted. Should the water in the outer vessel cool below 90° F. it should be reheated to 100° to 110° F. When the chocolate is all melted the inner vessel is removed and the chocolate is beaten or whipped for 2 to 3 minutes. The water is cooled to 85° to 90° F. and the chocolate vessel is returned to the outer boiler. When the temperature of the chocolate has fallen to approximately 85° F. dipping may be started.

Dipping.—The experienced candy maker hand-dips; that is, the fillers are placed in the chocolate and removed again with the fingers. The beginner, however, will be more successful with fork-dipping. The prepared centers or fillers are dropped one at a time into the melted chocolate, submerged in it, and then lifted out on a dipping fork or 2-tined table fork using it like a spoon. The filler is drained for just a moment and the "drip" from the lower side is scraped off on the stirring spoon or edge of the vessel. The finished candy is carried quickly to a paraffined or waxed paper where it is turned over and deposited upon the paper. The chocolate adhering to the fork may be drained off on top of the piece to give a finishing touch. If a heavy base forms on the pieces the chocolate is too hot. It should be cooled before proceeding. Should the chocolate become too stiff for dipping it may be thinned by heating the water in the outer boiler to 85° to 90° F. If the finished chocolates turn gray or become striped, either the chocolate has been heated too high or the room is too warm. The fillers should not be too cold—never below the temperature of the room.

Chocolates differ from most home-made candies in that they are generally improved by ageing a week or two. This is especially true of those fillers which contain fondant provided it is an acid fondant, also such fillers as are made up of acid fruits. The fondant in these chocolates becomes creamy upon standing for a few days but acid fruits like the cranberry will cause the fondant to become almost a liquid. Glucose or syrup fondants are not as well adapted for chocolate fillers as is the acid fondant.

FUDGE

Fudge is a mass of minute sugar crystals with these crystals surrounded by a film of butter fat which prevents the formation of crystals of noticeable size. A typical fudge is fine-grained and even in texture, and has a soft creamy consistency. The texture is largely determined by the temperature at which stirring or beating is begun, the higher the temperature the coarser the grain. A good fudge should not be coarsely granular. As a rule fudge does not store well. It is intended more for immediate consumption.

There are almost as many kinds of fudge as there are fudge makers. For that reason only one recipe will be given. The procedure is the same in all fudge making except for changes in materials used, other than the sugar, water, cream and butter. The finish temperature and the stirring temperature are the same as given in the following recipe:

M. A. C. Fudge.—The materials for a small batch are: Sugar, 1½ pounds; maple sugar, ¼ pound; water, 1 cup; light cream, ½ cup; butter, 1 ounce; candied fruit chopped fine, ¼ pound; and finely cut nut meats, 2 ounces.

The water, sugars, and cream are placed in a saucepan and brought to boiling. At this point the butter is added. Rapid boiling is maintained until the temperature reaches 234° to 235° F. (22° to 23° F. above boiling temperature of water). The crystals are wiped from the pouring side of the vessel and the hot syrup is poured into a shallow pan to cool. A thermometer is placed in the syrup and it is allowed to cool undisturbed to 110° to 120° F. The syrup is then quickly stirred to a heavy cream, at which time the nut meats and candied fruit are added, and stirred in and the entire mass is poured into a candy pan or shallow platter. Should the candy become too stiff to pour it may be kneaded in the hands for a few minutes until it becomes soft and plastic. It may then be packed into the candy pan or platter. After standing a short time it is cut into suitable pieces about one inch square and may be served at once or it may be stored for a few days.

Maple Cream Candy

The materials required are: granulated sugar, $1\frac{1}{2}$ pounds; maple syrup, 1 pint; cream, $\frac{1}{2}$ cup; butter, 1 ounce; finely cut nut meats, 1 to 2 ounces. The sugar, syrup and cream are mixed and heated to boiling. The butter is added and rapid boiling is maintained to a temperature of 236° to 237° F. (24° to 25° F. above temperature of boiling water). The vessel is removed from the fire and the crystals are wiped from the pouring side with a damp cloth. The syrup is then poured into a shallow pan. A thermometer is placed in the syrup and it is allowed to cool undisturbed to 110° to 120° F. The syrup is stirred or beaten until it becomes creamy, at which time the nut meats are stirred in and the candy is poured into a shallow pan. After cooling it is cut into inch squares. It may be stored for several days. If the candy becomes too stiff to pour it may be kneaded as given for fudge.

After-Dinner Mints

These are not fruit candies but no set of candy recipes would be complete without after-dinner mints. The materials required are: sugar, $1\frac{1}{2}$ pounds; water, 1 cup; cream of tartar, $\frac{1}{2}$ teaspoonful; extract of peppermint, 8 to 10 drops; extract of lemon, 2 to 4 drops.

The sugar, water and cream of tartar are placed in a vessel and boiled rapidly until the temperature is 260° to 264° F. (48° to 52° F. above temperature of boiling water). The vessel is removed from the fire and the crystals are wiped from pouring side of vessel with a damp cloth. The syrup is poured into a lightly buttered shallow pan. When cooled enough to handle the extracts are added and the mass is pulled until quite elastic. It is then pulled into a cylinder about one-half inch in diameter and cut with scissors into half-inch lengths forming the characteristic cushion shape of the after-dinner mint. The pieces are allowed to fall into a pan of confectioner's sugar. They are thoroughly mixed with the sugar and left in the pan until quite firm. They are then taken out, placed in cheesecloth and all adhering sugar is sifted out by shaking them about in the cheesecloth. These candies should be ready to serve, that is, they should be granular, within 24 to 48 hours. They may be stored for several weeks.

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CHAPTER XVII

PICKLED AND SPICED FRUITS

PICKLED FRUITS

These are whole or in relatively large pieces. They are characterized by the presence of vinegar and spices in sufficient quantities to modify both the taste and flavor of the fruit. The flavor is a pleasing blend of vinegar spices and fruit. The fruit should be tender, plump and sub-acid to tart in taste. Pickled fruits are as a general rule made from the hard or fleshy fruits and when finished the pickles are packed with the pickle solution.

There are several methods by which pickled fruits are prepared. Only two of these will be given.

1. The fruit is prepared as for canning, and packed into clean, dry jars. The jars are filled with a pickle solution and are then processed in the water both the same as when canning. The pickle solution is made by mixing together 1 part vinegar and 2 parts water. To this is added 1 ounce (2 tablespoonfuls) of mixed pickling spices or equal amount of other spices, which are loosely tied in a thin muslin bag. The spice bag, water and vinegar are placed in a vessel and simmered for 30 to 40 minutes. The original volume is restored by adding water. One pound of sugar is added for each quart of liquid. The pickle solution is brought to boiling and poured over the packed fruit. The jars are partially sealed and processed as directed above. This method is adapted to such fruits as pears, peaches, plums, etc.

2. A second method of procedure, which usually gives higher quality, provides for thorough cooking of the material before packing. The cooking may be done in water or in the pickle solution. If the material requires long cooking, water is used. If the cooking period is relatively short or if the fruit is juicy, the cooking is made in the pickle solution. The pickled fruit may be packed at once or it may be allowed to stand for a day. The latter practice should be followed if the fruit is tender and liable to break up while packing. A few hours in the pickle solution tends to make the fruit firm, which greatly improves its handling quality.

The taste of any pickled fruit primarily depends upon the relative amounts of acid in the vinegar and the fruit and the ratio of sugar used. The relative amounts of vinegar and sugar may be varied to suit the individual taste so that pickles ranging from sweet to quite acid may be made. The recipes which follow are based upon standard commercial grade of cider vinegar which is approximately 4 per cent acid.

Less color will be imparted to light-colored fruits if white vinegar is used. The pickle maker, however, should remember that this gain in color is offset by loss of the flavor that is characteristic of good cider vinegar.

Pickled Pears

The fruit should be ripe but firm. It is peeled, cut into halves or quarters and cored. Small fruits may be left whole if desired. The peeled fruit is dropped into a salt solution (1 tablespoonful of salt per quart of water) to prevent discoloring. When the fruit is all prepared it is rinsed and placed in the pickle solution. A good pickle solution is made by mixing together for each 2 pounds of fruit, 1 cup of good vinegar, 2 cups of water, ¾ to 1 pound of sugar and 1 ounce mixed whole pickling spices tied loosely in a muslin bag. These materials, except the sugar, are simmered for 30 minutes. The original volume is restored by addition of water. (The sugar is stirred to solution and the fruit is added.) The vessel is covered and slow boiling is maintained until the fruits are tender and have a clear, translucent appearance.

The fruit is removed and packed, not too tightly, into clean, dry jars. The pickle solution is reduced by rapid boiling to approximately one-half its volume. The hot pickle solution is poured over the packed pickles, filling the jars full. The jars are partially sealed and processed for 2 or 3 minutes in the water bath.

Ginger Pears.—The fruit is prepared as directed for pickled pears except that it is generally cut into medium thin slices. The prepared fruit is removed from the salt solution and rinsed in clear water and weighed. It is placed in a cooking vessel and water added to just float the fruit. Heat is applied and slow boiling is maintained until the pieces become tender. The water is drained from the fruit and strained through cheesecloth to remove all particles of pulp. The pickle solution is prepared by allowing for each pound of prepared fruits ½ cup of the water in which the pears were cooked, ½ pound sugar, juice and grated or finely cut rind from ½ lemon and ½ to ¾ ounce of finely sliced crystallized ginger. Heat is applied to dissolve the sugar. The fruit is added and is boiled slowly for 2 or 3 minutes. It may be packed hot

but better results will be had if fruit is allowed to stand overnight. It is then packed into clean, dry jars. The syrup is concentrated by boiling to approximately $\frac{3}{4}$ cup per pint jar of packed fruit. The hot syrup is then poured over the fruit. The jars are partially sealed and processed in the water bath for 10 minutes.

NOTE.—Sweet and very mild sub-acid apples may be prepared in the same way. Sub-acid and acid apples pulp too readily to be satisfactory.

PICKLED PEACHES

Peaches should be hard-ripe. If freestone they are peeled and halved. If clingstone they are peeled and left whole. The pickling process is the same as given for pears.

PICKLED PLUMS

The meaty varieties of plums may also be pickled. They are blanched long enough to cause the skins to slip off easily and are then treated as directed for pears. If plums are quite acid the sugar ratio should be increased 2 or 3 ounces per pound of fruit.

PICKLED SWEET APPLE

The sweet apples when hard-ripe make excellent pickles. They are peeled, quartered, and cored. If the fruits are small the quarters are left entire, if medium to large in size they are cut lengthwise into two or three slices. The procedure is the same as given for pears.

PICKLED WATERMELON RIND

The rind from a well-ripened melon is most satisfactory. The rind is cut into narrow strips. The inner ripe pulp and the outer green peel are removed. The clear white rind remaining is then cut into convenient size pieces, approximately $\frac{1}{2}$ inch by 1 inch or larger. There are many methods of procedure from this point. Only two of these will be given. (1) The prepared rind is placed in a 40° salometer brine (4 ounces salt per quart of water) and left for 24 hours before freshening and cooking. (2) The prepared rind is boiled slowly in a 20° salometer brine (2 ounces salt per quart of water) for 30 minutes. This brine is discarded and the rind is freshened by parboiling for 5 to 10 minutes in two or three changes of clear water. The freshened rind is then boiled slowly in clear water until tender. The time required depends upon the size of the pieces but is usually $1\frac{1}{2}$ to 2 hours.

The pickle solution is made by mixing equal parts of good vinegar and water ($1\frac{1}{2}$ cups each per pound of rind). White vinegar will cause less discoloring of the finished pickle. One ounce (two tablespoonfuls) of whole mixed spices is tied loosely in a thin muslin bag. The spice bag is simmered for 30 minutes in the mixture of vinegar and water. At the close of the simmering period $\frac{1}{2}$ pound of sugar per pound of prepared rind is added and stirred to solution. The cooked rind is now placed into the pickle solution and the whole heated to the boiling point. The vessel is removed from the fire and is allowed to stand for 24 to 48 hours. The pickle solution is then drained from the pickles and $\frac{1}{2}$ pound sugar per pound of rind is added. The pickle solution is heated to boiling and returned to the pickles. After standing for 1 or 2 days the solution is again drained off. The pickles are packed into clean, dry jars. If a tart pickle is preferred the pickle solution is heated to boiling and poured over the packed pickles filling the jars full. If a sweet pickle is desired the pickle solution is concentrated by rapid boiling to volume just sufficient to fill the jars, that is, $\frac{3}{4}$ cup per pint jar. The concentrated solution is then filled into the jars. The jars are partially sealed and processed in the water bath for 2 or 3 minutes.

Ginger Watermelon Rind.—The watermelon rind is prepared and cooked tender as given under pickled watermelon rind. The process is then the same as given under ginger pears.

SPICED FRUITS

These differ from pickled fruits in that the finished product is more of a pulp and also by the absence of any appreciable amount of free liquid. Exception should be made in the canning of certain fruits in syrup to which some whole spice is added. Spiced fruits are as a rule made from the soft fruits. They are sub-acid to tart and have a blended flavor of vinegar spices and fruit. Spiced fruits like pickled fruits are eaten as a relish rather than as dessert.

When making spiced fruits the vinegar and spices are generally added directly to the fruit. As the spices themselves become a part of the finished product a less quantity is used than when making pickled fruits. In the case of bright-colored fruits, like cranberries and currants, where the color is somewhat darkened by the spices, it has become a general practice to use larger amounts of spices, but instead of adding them directly to the fruit they are tied up in a thin muslin bag and the bag of spices is allowed to cook with the fruits. This discoloration may also be overcome by substituting extracts of spices.

No rule for use of extracts can be formulated since they vary so much in their strength.

Spiced Cranberries

All soft and decayed fruits are removed and the berries are washed. The fruit is then measured or weighed (one quart weighs one pound). The fruit is run through a food chopper using the medium coarse cutter. The chopped fruit is placed in a saucepan and for each pound of fruit $\frac{1}{4}$ cup of good flavored vinegar, $\frac{1}{2}$ cup of water, $\frac{3}{4}$ to one pound of sugar, and $\frac{1}{4}$ teaspoonful each of ground cinnamon, cloves and allspice is added. If spices are not added direct the amount is doubled and they are tied loosely in a muslin bag which is discarded when the product is finished. Cooking should proceed at rapid boiling with frequent stirring until the hot material will round up somewhat on the spoon or the syrup will almost give the jelly test. The hot product is filled into clean, dry jars, filling them full. The jars are sealed while hot and allowed to cool before storing.

Spiced Currants

Currants are spiced in the same manner as given for cranberries except that the currants are not run through the food chopper.

The filled containers should be only partially sealed and processed in the water bath for 1 or 2 minutes. After processing jars are sealed and allowed to cool before storing.

Spiced Crabapples

The fruit should be ripe, sound and free from blemishes. The stems are usually left on. Each three pounds of fruit will require the following materials for making the pickling solution: 1 cup water, 1 cup good vinegar, $\frac{3}{4}$ pound of sugar, $\frac{1}{2}$ ounce of broken cinnamon bark or cassia bark and $\frac{1}{4}$ ounce of whole cloves. The fruits are simmered in the pickle solution until tender. They are then set aside and allowed to stand for 24 hours. The syrup is drained from the fruit. The fruit is packed loosely into clean, dry jars. The syrup is concentrated to two-thirds or one-half its volume and poured over the packed fruit. The jars are partially sealed and processed in the water bath for 2 or 3 minutes.

A shorter method which gives a mildly flavored pickle is to pack the prepared fruit into clean, dry jars and pour over them a pickle solution which is made as directed above but which has been simmered for 30 to 40 minutes to extract the flavor from the spices. The jars are processed in the water bath, pints for 25 minutes, quarts 30 minutes.

Spiced Grapes

The grapes should be well ripened. The berries are removed from the clusters, weighed, washed, and drained. They are pulped, that is, the berries are pressed between thumb and fingers separating the skin and outer soft pulp from the inner fibrous pulp. The skins and pulps are kept in separate pans. The pulps are placed in a cooking vessel and heated slowly until the juice flows freely, then boiled slowly until the pulps are soft or in pieces. They are then rubbed through a colander or wire sieve to remove the seeds. The skins are run through the food chopper, using a medium fine cutter. The chopped skins are placed over the fire with $\frac{1}{2}$ cup water per pound of fruit and boiled slowly for 15 to 20 minutes in a covered vessel. The pulps are added to the cooked skins and for each pound of prepared fruit, $\frac{1}{4}$ cup of vinegar, $\frac{1}{2}$ to $\frac{3}{4}$ pound of sugar, $\frac{1}{2}$ teaspoonful of ground cinnamon and $\frac{1}{4}$ teaspoonful of ground cloves is added. Cooking should be at rapid boiling with frequent stirring until the syrup will almost give a jelly test.

The finished product is filled into clean, dry containers, filling them full. The jars are partially sealed and processed in the water bath for 2 or 3 minutes. After processing the jars are sealed and allowed to cool before storing.

Grape Ketchup

This is a modified form of spiced grapes used almost exclusively as a relish with meats. The fruits should be thoroughly ripe. The grapes are removed from the clusters, weighed, washed and drained. The prepared fruit is placed in a saucepan and some of the fruits crushed. Heat is applied gently until the juice flows freely, then moderate boiling with frequent stirring is maintained until the fruit is thoroughly cooked. The pulps are forced through a fine wire sieve to remove skins and seeds. The pulps are returned to the saucepan and there are added: $\frac{1}{4}$ cup vinegar, $\frac{1}{2}$ pound sugar, 1 teaspoonful of cinnamon, and $\frac{1}{2}$ teaspoonful of cloves per pound of fruit. The mixture is boiled moderately with frequent stirring until the hot pulps will almost sheet from the spoon. The finished ketchup is filled into clean, dry containers and processed in water bath for 2 or 3 minutes.

Other Spiced Fruits

Blueberries and elderberries are sometimes spiced. They are treated in the same way as given for cranberries except that the sugar ratio should be reduced two or three ounces per pound of fruit. Also the finished product should be processed in water bath for 2 or 3 minutes.

REFERENCES

See Chapter X, Fruit Products.

CHAPTER XVIII

VEGETABLE PICKLES AND RELISHES

The two most important classes of vegetable products are: (*a*) pickles—used in its broad interpretation, and (*b*) relishes. These two classes include a very large number of vegetable products widely variable as to nature and content—yet very similar as to uses. Many of them are characterized by a relatively high acidity and by the use of large amounts of salt in their manufacture. Since vinegar and salt are so necessary in manufacturing many of the pickles and relishes a brief discussion of these two materials will be given here.

VINEGAR

The two most commonly used vinegars are cider vinegar and white vinegar.

Cider vinegar is especially prized for its excellent flavor and for its aromatic qualities in addition to its mellow acid taste. Its one objectionable feature is its tendency to discolor the lighter colored and white vegetables. Onions or cauliflower placed in cider vinegar take on the reddish brown color of the vinegar and though not so attractive to the eye have excellent flavor and aroma.

White Vinegar.—This may be either a white grape vinegar or a distilled vinegar. The latter is coming into more general use and for general manufacturing purposes is rapidly replacing all other white vinegars. It is a by-product of the yeast industry and because of this it is relatively cheap. It is lacking in appetizing flavor and aroma and because of this the acid seems more harsh than that of cider vinegar. Pickles and relishes that contain green vegetables have this color intensified in white vinegar. Vegetables like onions and cauliflower retain their clear white color.

A general rule then is to use cider vinegar when flavor and aroma are paramount and white vinegar for color.

Functions of Vinegar.—In the manufacture of pickles and relishes vinegar functions in several ways: (*a*) to modify the taste and flavor, (*b*) to aid in control of a desired type of fermentation and (*c*) as a preservative.

SALT

Salt is an important agent in the manufacture of all vegetable products. Its principal functions are: (*a*) improves taste and flavor, (*b*) hardens the tissues, (*c*) controls fermentation, and (*d*) acts as a preservative.

(*a*) *Taste and Flavor.*—All vegetable products are improved in both taste and flavor by the judicious use of salt. In making some products, salt is added in excess to hasten the release of juices which, later, are discarded, for the purpose of improving quality.

(*b*) *Hardening.*—Salt tends to harden vegetable tissues. It reduces the solvent action of pure water. Green or immature, fibrous vegetables such as cucumbers, string beans, cauliflower, etc., treated with salt become firmer and more crisp.

(*c*) *Control of Fermentation.*—Some bacteria of the lactic acid group are tolerant of a relatively large amount of salt; that is, they continue their activity in the presence of considerable salt. Putrefactive and other spoilage bacteria are not as tolerant and consequently they are dormant or only very slowly active in a salt solution such as would encourage growth of the lactic acid group. The pickle manufacturer takes advantage of this fact by adding salt to his vegetables in such quantities as will permit active growth of the lactic acid group while holding all others in check.

The salt may be added in its natural state as *dry salt* or it is dissolved in water to form a *brine.*

Dry Salt.—When used in sufficient quantities salt functions as a preservative. Vegetables packed with approximately one-quarter of their weight of salt may be kept for many months without danger of spoiling. If used in less amounts—2½ or 3½ per cent of the weight of the vegetables—a lactic acid fermentation takes place and a wholesome food product is the result. The vegetables are preserved in a mixture of salt and lactic acid. The most familiar example of this type of product is sauerkraut.

Brine.—The amount of salt in solution determines the density of the brine. A saturated solution contains 26½ per cent salt or is 100 per cent of a saturated solution. The density of brine is generally determined by means of a special hydrometer called a salometer or salinometer. When this salometer is floated in clear water it reads 0 per cent on the scale. When floated in a saturated brine it reads 100 per cent on the scale. The instrument is then calibrated to read per cent of saturation rather than per cent of salt in solution. If the per cent of salt in solution is desired it may be computed by multiplying 26½

by the salometer reading. Thus a 40 per cent salometer brine would contain 40 × 26½ or 10.6 per cent salt in solution.

Brines less than 40 per cent salometer are rarely used in fermenting vegetables except in the manufacture of dill pickles, where a 20 per cent salometer brine is required. The control of spoilage bacteria in this weak brine, however, is aided considerably by the addition of a small amount of vinegar.

The fermenting period varies with different materials and with the temperature. Dill pickles are finished in approximately two weeks, whereas salt pickles and other pickled vegetables which must be fermented in a more concentrated brine require about six weeks. The density of the brine for pickles and most pickled vegetables should be kept fairly constant around 40 per cent salometer.

If a salometer is not available the following table will enable one to closely approximate brines of different densities:

Salometer Reading, Per Cent	Salt per Quart of Water, Ounces	Character of Brine
20	2	Used with dill pickles
40	4	This brine just floats an egg. Used with pickles and most pickled vegetables
60	6	Checks fermentation. Generally used to store fermented vegetables
80	8	Stops fermentation
100	10	Saturated solution

PICKLES

According to "the standards of purity for food products," "Pickles are clean, sound, immature cucumbers, properly prepared without taking up any metallic compound other than salt, and preserved in any kind of vinegar with or without spices. Pickled onions, pickled beets, pickled beans, and other pickled vegetables are vegetables prepared as described above and conform in name to the vegetable used." (See Appendix B.)

Methods of Manufacture.—Pickles and pickled vegetables are manufactured either by the fermentation process or by the so-called quick process.

Fermentation.—This method is used by all commercial pickle makers and within recent years following the work of Dr. Lefevre of the United States Department of Agriculture many home manufacturers of pickles

have adopted this method. Pickled products produced by fermentation are superior to all others in quality and appearance. Cucumbers, string beans, cauliflower, and onions are the commonly used vegetables.

These vegetables properly prepared are placed in a brine which carries sufficient salt to give control to the desired type of fermentation. As soon as the vegetables are placed in the brine osmotic action begins and continues until a state of equilibrium is established between the brine and the juice of the vegetable. Due to the osmotic action the juice is drawn from the vegetable into the brine and the brine is taken up by the vegetable. At first the flow of juice outward is more rapid than the inflow of brine. This causes a slight shriveling of the vegetable. Later the inward flow is sufficiently rapid to cause the vegetable to become firm and plump again.

The juice that is drawn out of the vegetable contains among other things small amounts of sugars in solution. It is these sugars that are attacked by the lactic acid bacteria present and converted into lactic acid. At the close of the fermentation period the vegetable is preserved in a mixture of brine and lactic acid. The vegetable itself has also undergone some physical changes. It is firmer and more crisp and its flavor and taste have both been changed. If of green color, as in cucumbers and green string beans, there is also a noticeable change from the bright natural green to olive green.

Vegetables so treated are known as salt pickles or salt stock. They may be kept for long periods if properly protected or they may be manufactured at once into the common types of edible pickles such as sweet pickles, sour pickles, mixed pickles, etc.

Quick Process.—By the quick process fresh cucumbers and vegetables are converted at once into edible pickles and pickled products by the addition of a pickle solution of vinegar, spices, etc., and without fermenting the vegetables.

This is the common method of making the products in the home. It has the advantage of being a less exacting method than that of fermentation and although the products are not of as high quality they are well worth the making; thus where the fermentation process is not practicable the quick process is highly recommended for the production of all kinds of pickles and pickled vegetables. (See page 195.)

Fermented Pickles (Salt Pickles)

At the stations where cucumbers are fermented in large quantities the procedure is as follows: As the cucumbers are brought in from the field they are rinsed to remove excess soil and sand and thrown into huge tanks. Sufficient 40 per cent salometer brine is added to cover.

When the tank is filled the brine is tested and salt sufficient to restore proper density of 40 per cent is placed on the board cover which has been placed in the tank to keep the cucumbers submerged. The salt slowly goes into solution, since the liquid level is above the board cover. The brine thus formed being heavier than the other liquid in the tank, it is slowly diffused throughout the tank, maintaining a uniform brine throughout. At the end of each week for five or six weeks the brine is tested and additional salt is placed on the board cover. In this way a brine of sufficient density is maintained to insure proper curing of cucumbers. When fermentation is completed salt is added to raise density of brine to around 50 to 60 per cent salometer and water is added as needed to maintain the proper level. The scum of yeasts and molds which forms on the surface should be removed from time to time.

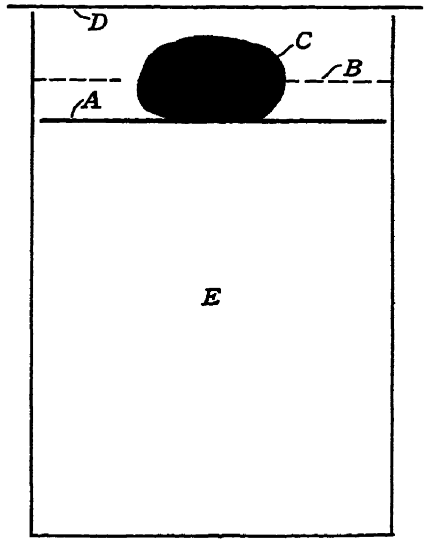


FIG. 38.—Diagram of a keg or vat of fermenting pickles.

A, the board cover or false head; *B*, the surface of the brine; *C*, the weight to keep the false head submerged; *D*, the cover; *E*, the vegetables.

This same method may be used on a much smaller scale, employing barrels instead of tanks. By carefully testing the brine and adding salt to maintain the optimum density (35 to 40 per cent salometer). The cucumbers may be added from day to day as they are brought from the field. When the barrel is filled to within a few inches of the top an inner wood cover is placed over the cucumbers to keep them submerged. The salt necessary to maintain proper brine strength (approximately 3 pounds) is added each week for five or six weeks after filling. Toward the last of the fermentation the salt is increased so that when stored the pickles are in a brine of 50 to 60 per cent salometer. The scum which forms on the surface must be removed every few days and water must be added as necessary to maintain proper level of the brine.

When fermentation is completed the head is restored and the barrel is laid on its side, the bung is removed and the barrel is filled up with 50 to 60 per cent salometer brine. The bung is replaced and the barrel is stored in a cool place.

Other vegetables, cauliflower, onions, string beans and green tomatoes, may be fermented in the same way. Cauliflower may be left in the heads or the heads may be broken up into a number of the natural divisions. Onions may be blanched and peeled or the skins may be left on and removed after fermentation. Onions should be kept in a brine around 40 to 45 per cent salometer and stored in brine of 60 per cent salometer. String beans should be snipped. They may be cut or left whole. Green tomatoes if small are left whole; large ones are either cored or are cut into halves.

The addition of a small amount of vinegar to the vegetables before fermentation begins will sometimes prevent loss of materials. Most spoilage bacteria are not very active in a week acid solution. In small lot fermentation the vinegar should not be more than a half-cup per gallon of brine.

Home Method.—The home manufacturer who desires to handle pickle making on a small scale will proceed as follows:

The cucumbers are weighed and washed thoroughly. They are then packed into a suitable size jar, packing to within two or three inches of the top. A brine of 40 per cent salometer density (4 ounces salt per quart of water) is poured in, filling the jar to within an inch of the top. A plate or round board of tasteless wood is placed in the jar and weighted to keep the vegetables submerged, and a cover is placed over the top of the jar. The next day after filling, coarse salt at the rate of 1 pound for each 10 pounds of vegetables is placed on the inner cover of the jar. At the end of each succeeding week ½ pound of salt per 10 pounds of vegetables is placed on the cover. Fermentation should be completed by the end of six to eight weeks. The scum which forms on the surface of the brine should be removed every few days.

When fermentation is completed the cucumbers may be packed in large jars, two-quart or four-quart, the brine poured in to fill the jars full, and the jars sealed and stored in a cool place. Or a layer of hot paraffin may be poured over the brine in the jar in which the pickles were fermented. This jar should be stored in a cool place until ready to convert into table pickles.

Dill Pickles

Dill pickles may be made from salt pickles by freshening and packing with dill and vinegar. But as a rule they are made from fresh cucumbers. The larger sizes of cucumbers are made into dill pickles, but if desired the smaller sizes may be used. Their manufacture differs from that of salt pickles in that less salt is required, and spices and vinegar are added. The principal spice and the one that gives the char-

acteristic flavor is the dill plant. The use of a weaker brine allows more rapid fermentation and consequently a relatively shorter period is required than in making salt pickles. However, the dill pickles have poor keeping quality due to the small amount of salt present. Greater care is therefore necessary to prevent spoilage than in the case of salt pickles.

Cask or Barrel Fermentation.—Where dill pickles are made in sufficiently large quantities the ordinary size cask or barrel is used. The container should be free from all odors and flavors which might contaminate the pickles.

For an average size barrel of 45 to 50 gallons 6 to 8 pounds of fresh dill plant and 1 pound of mixed pickling spices are required. The washed, evenly graded cucumbers together with the dill and spices are packed uniformly throughout the barrel, packing it full. The head is replaced and the barrel left standing on end. A hole is made in the head through which is poured 1 gallon of good vinegar and enough 20 per cent salometer brine to fill the barrel full and to form a layer over the top. The brine is made by dissolving 2 ounces of salt per quart of water. Brine must not be hot when poured over the cucumbers. New brine must be added as required to maintain a layer over top of barrel.

Active fermentation will begin within 2 or 3 days, as indicated by escape of gas bubbles through the layer of brine over the head. The scum of yeasts and molds that form should be removed every few days. When bubbles no longer escape, active fermentation is completed and the hole in the head is tightly plugged and the barrel is stored in a cool place. The period of active fermentation occupies 10 days to 2 weeks if the temperature is around 80° to 85° F.

Home Manufacture of Dill Pickles.—An earthenware jar or small keg holding 4 to 6 gallons will be large enough for ordinary home use. The vessel should be clean and cucumbers must be thoroughly washed. A five-gallon vessel will require 1 to 1½ ounces mixed pickling spices and about ¾ to 1 pound of fresh dill plant. Usually in packing the keg it is customary to place a layer of dill and spices on the bottom, in the middle and at the top. If to be left open the contents should come to within 2 or 3 inches of the top. A circular board of tasteless wood or a plate is placed over the top of the packed materials and weighted to keep the cucumbers submerged. The brine should cover the contents to a depth of about one inch. The packed keg is placed where the temperature will be reasonably uniform around 80° to 85° F. The pickling solution added to the cucumbers consists of 3 cups of good vinegar and enough 20 per cent salometer brine to fill the container as indicated above. New brine must be added as required to maintain the level of

the liquid over the materials. A cover over the top of container will reduce evaporation and lessen scum growth. The layer of scum which forms on the top of the brine should be removed every few days.

Fermentation should be completed in two weeks. If cool storage is available the pickles may be left in the container. The scum is carefully removed and a layer of warm paraffin is poured over the surface of the brine. This excludes the air and under cool storage conditions will keep the pickles. Storing the finished pickles in glass jars is better, however, for home use. The cucumbers are packed into clean glass jars, the brine is heated to boiling, then allowed to cool somewhat, and is poured into the packed jars, filling them full. The jars are sealed and stored in a cool place.

PICKLES FROM SALT STOCK

When the fermented cucumbers or other vegetables are thoroughly cured they may be made into the various kinds of edible or table pickles such as sour pickles, sweet pickles, mixed pickles and mustard pickles.

Sour Pickles

The salt pickles are freshened (excess salt removed) by standing in several changes of clear water, each standing period being 2 to 6 hours. Or they may be placed in a vessel and set under the tap and a small stream of water allowed to flow into the vessel overnight. If all the salt is removed then enough for taste and flavor should be added to the pickle solution later in the process.

The freshened pickles are placed in an earthenware, enameled, or wood vessel and a weak vinegar made by taking 1 part of good flavored vinegar and 1 part water is poured over them. The volume should be sufficient to cover the vegetable. They should be left in this vinegar for 3 to 5 days. After this the vinegar is brought to 3 per cent acid (see page 206), or it may be discarded and new vinegar made by mixing 1 part water with 2 parts vinegar. The vegetables should be left in this vinegar for 3 to 6 days. The vinegar may be drawn off, tested and brought to 3.5 per cent acid or stronger if preferred; or one quart of good vinegar may be added to each gallon of the drained vinegar. A few days in this last vinegar will complete the pickles. They may be left in the jar in which made or the pickles may be packed in suitable size glass jars. The vinegar is heated to boiling and poured over the pickles, filling the jars full. Rubber rings are adjusted and the jars are sealed at once.

Sour pickles may spoil if vinegar is less than 3½ per cent acid. Vine-

gar up to 5 per cent acid may be used in which to store pickles if desired, but $3\frac{1}{2}$ to 4 per cent will give a much less acid taste.

Sweet Pickles

Commercial Method.—The salt pickles of small and medium size only are freshened in several changes of clear water. They are then placed in casks and covered with 3 to $3\frac{1}{2}$ per cent vinegar. After two or three days this weakened vinegar is drawn off and either discarded or tested and made up to original acid strength by adding vinegar of standard acid content. If the weakened vinegar is discarded a fresh vinegar of 3 to $3\frac{1}{2}$ per cent acid is made by diluting the standard vinegar with water. The pickles are allowed to stand in this second vinegar for 3 to 5 days. The vinegar is now drawn off, tested and made up to $3\frac{1}{2}$ per cent acid by addition of standard vinegar. At this time a part of the sugar is added. The vinegar necessary to cover the pickles is measured. Sugar at the rate of $2\frac{1}{2}$ to 3 pounds per gallon is added, stirred to solution and poured over the pickles. After 3 to 5 days the vinegar is drawn off, measured and $1\frac{1}{2}$ to 2 pounds of sugar per gallon are added. At this time spices are also added. The mixed whole pickling spices are most satisfactory. These should be used at the ratio of 1 to 2 ounces per gallon of vinegar. The spices are tied loosely in a cheesecloth bag placed in the vinegar and heated to a simmer in a covered vessel for 1 hour. This is now the pickle solution. It is allowed to cool and the original volume is restored by addition of water. This solution is poured over the pickles. If the pickles are not sweet enough after standing for 1 week the solution may be drained off and 1 to 2 pounds sugar per gallon are added. The pickle solution is returned to the pickles and after 1 week they are finished. The pickle solution may be made by saccharometer test, if preferred. If $3\frac{1}{2}$ pounds per gallon are added at the beginning the syrup will test about 30 per cent sugar on the Brix or Balling saccharometer. After 1 week the solution is again tested and sugar is added to bring it up to 40 per cent (see page 78). The solution is again tested at the end of another week and sugar is added to bring the vinegar to 40 per cent. This is about the usual density used. The finished pickles may be left in the cask or keg or they may be packed into clean, dry glass containers. The pickle solution is heated to boiling and is poured over the pickles filling the containers full. They are sealed at once and stored. These pickles should keep for many months.

Home Method.—Since the home manufacturer of sweet pickles does not have the necessary equipment for testing syrups and vinegars they must rely upon rule of thumb methods.

On the basis of 1 gallon of small to medium size pickles the procedure would be as follows: The pickles are freshened by placing in a vessel under a tap of slowly running water or by allowing to stand for 2 to 3 hours in each of 3 to 4 changes of clear water. Commercial vinegar should be used because its acid content is known whereas home-made vinegar will vary from 3½ to 6 or 7 per cent acid. The freshened pickles are placed in an earthenware jar and covered with a weak vinegar made by adding 3 cups of water to 10 cups of good commercial vinegar. On the third day following the vinegar is drained from the pickles. Six cups are reserved, the remainder is discarded. To the 6 cups of vinegar an equal amount of good commercial vinegar is added. This vinegar is returned to the pickles. After 3 to 4 days the vinegar is again drained off. To 7 cups of this vinegar 5 cups of good commercial vinegar and 1½ pounds of sugar are added and slow heat is applied to just effect solution of the sugar. The sweetened vinegar is poured over the pickles and allowed to stand for 3 to 5 days. The vinegar is drawn off and 1½ pounds of sugar are added. Heat is applied to hasten solution. The vinegar is measured and returned to the saucepan. The spices are added at this time 1 ounce of mixed whole pickling spices is tied loosely in a muslin bag and added to the vinegar. The vessel is covered and the simmering temperature is maintained for 40 to 60 minutes. The original volume is restored by adding water. This pickle solution is poured over the pickles. The spice bag may be added to insure sufficient spicing. After 1 week the solution is drawn off and 1½ pounds of sugar is added, heating to dissolve. The pickles are finished after standing for 1 week in this pickle solution. They may be left in the jar if covered or they may be packed into clean, dry glass jars. The pickle solution is heated to boiling and is poured over the packed pickles filling the jars full. The jars are sealed and stored.

This seems a rather long and tedious process but the product will justify it.

Mixed Sweet Pickles

Mixed sweet pickles are usually made by combining small pickles or more frequently larger pickles sliced or chopped, with cauliflower, string beans, and onions. There is no general rule regarding proportions of materials. Each packer has his own system and the variation is very great.

The only difference in the manufacturing process for mixed pickles and for sweet pickles lies in the necessary preparation of the vegetables other than the cucumbers. All vegetables must be freshened. The cauliflower is cut or broken into its small divisions and is then cooked

in water at boiling point until tender. The beans may be left whole or cut into short lengths and these as well as the onions are boiled slowly in water until tender. The cooked vegetables are cooled and drained, the mixture is made and from this point on the process is identical with that given for sweet pickles.

Note.—Vegetables may be used uncooked if preferred but as a rule, they are less satisfactory.

Mustard Pickles

Mustard pickles are as a rule made from a mixture of several vegetables. These may be fresh or fermented. If the fermented vegetables are used they are first freshened and the overnight period in brine, recommended for fresh vegetables, is omitted. Otherwise the process is the same.

Almost any combination may be made. The following is suggestive and may be modified to suit individual taste. The vegetables are: 2 pints sliced cucumbers, 1 pint pickling size onions, 1 pint cut string beans, 1 pint cauliflower, ½ cup each of chopped red and green sweet peppers and 1 cup sliced or diced carrots. The vegetables if fresh are soaked overnight in a gallon of water to which is added 1 cup of salt. The following day the vegetables are drained and freshened by standing for 1 hour in each of two changes of clear water. The freshened vegetables are then placed in a weak vinegar made by adding 1 quart of vinegar to 1 quart of water. They should be left in this for 24 to 48 hours.

The materials for the dressing are 1½ quarts good vinegar, 1 cup brown sugar, 3 tablespoonfuls ground mustard, 4 tablespoonfuls of flour, 2 teaspoonfuls turmeric, 1 tablespoonful celery seed. The dry materials are mixed together and the vinegar is added a little at a time to form a smooth paste. The dressing is heated in a double boiler until thick. The vegetables are drained and the hot dressing is poured over them. Stirring is necessary to mix thoroughly.

The pickles are packed into clean, dry jars. The jars are partially sealed and processed in the water bath pints 5 minutes and quarts 8 minutes.

QUICK PROCESS PICKLES

Small and medium size cucumbers are used in making pickles by this process. The cucumbers are thoroughly washed and drained and placed in a weak brine made by adding 1 cup of salt to 1 gallon of water. The cucumbers are left in this brine for 24 hours. These cucumbers may be made into either sour or sweet pickles.

Sour Pickles

The cucumbers are drained and placed in a mixture of 1 part water and 3 parts good vinegar. The volume of vinegar should be sufficient to cover the cucumbers thoroughly. They are left in this vinegar for 3 or 4 days or they may be set over fire and heated to the simmering temperature for 2 or 3 minutes. In either event the cucumbers are packed moderately tight into clean jars. The vinegar is heated to boiling and poured over the pickles filling the jars full. The jars are sealed at once.

Sweet Pickles

The sweet pickle solution is made as follows: vinegar of good flavor is diluted by adding 1 cup of water to 3 cups of vinegar. Sugar is added in the ratio of $\frac{3}{4}$ pound per quart of the dilute vinegar. Spices may be of kind and amount desired but 1 ounce of mixed whole pickling spices per gallon of pickle solution will give a good flavor. The spices are tied loosely in a muslin bag placed in the vinegar sugar solution and simmered in covered vessel for 45 to 60 minutes. The loss in volume due to evaporation is made up by adding water. This spiced pickle solution is poured over the cucumbers and they are set aside for 2 or 3 days. The pickle solution is drained off and sugar in ratio of $\frac{1}{2}$ to $\frac{3}{4}$ pound per quart is added and stirred to solution, heating if necessary. This pickle solution is poured over the pickles and they are set over the fire and simmered for 5 to 10 minutes. They are then set aside for 2 or 3 days before packing. The pickles are packed moderately tight in clean jars. The pickle solution is heated to boiling point and poured over the pickles, filling the jars full. They are partially sealed and processed in the water bath for 2 or 3 minutes.

If sweet pickles shrivel it is an indication that the pickle solution contained too much sugar, or that the cucumbers were not heated sufficiently.

Pickled Beets

Small beets $1\frac{1}{2}$ inches in diameter or less are blanched and skins are removed. The prepared beets are packed into clean, dry jars. The jars are filled with a hot vinegar solution made by mixing 1 part water with 3 parts vinegar. The jars are partially sealed and processed in the water bath, pint jars 100 minutes and quart jars 120 minutes.

If a sweet spiced pickle is preferred to the above mildly acid one the pickle solution is prepared as follows: To each quart of vinegar prepared as above $\frac{1}{4}$ ounce pickling spices and 1 to 2 cups of sugar are added.

The spices are tied loosely in a muslin bag. The pickle solution is simmered in a covered vessel for 40 minutes. The original volume of pickle solution is restored by adding water.

Pickled Carrots

Young and tender carrots make very acceptable pickles. The skins are removed (see page 87) and they are treated in the same manner as beets.

Pickled Cabbage

This is an unfermented product and may be used as a substitute for sauerkraut. The materials most commonly used are: 4 quarts of finely shredded cabbage, 1½ tablespoonfuls salt, ¼ cup mustard seed, ¼ cup mixed pickling spices, 2½ cups sugar and 2 quarts good cider vinegar.

The shredded cabbage is mixed with the salt and packed firmly into a crock. The next day all free brine is poured off and discarded. The spices are tied loosely in a muslin bag and simmered in the vinegar for 30 minutes. The original volume of the vinegar is restored by adding water. The sugar is stirred to solution in the hot vinegar. The spice bag is discarded and the hot vinegar is poured over the cabbage. After 24 hours the pickle is packed moderately tight into clean, dry jars. The jars are processed at 180° F. (simmer) for 10 minutes.

Cucumber-Oil Pickles

The cucumbers should be small to medium in size (2½ to 3½ inches). They may be fermented—salt stock—or green. If fermented they will require freshening. Small cucumbers are sliced, the medium size are peeled before slicing. The slices should be thin. For each quart of sliced cucumbers the following materials are required: ⅓ cup olive oil or other good salad oil, 1½ cups good vinegar, 1 tablespoonful mustard seed, 1 teaspoonful celery seed; two small onions, sliced, may be added if desired.

The sliced cucumbers are covered with 1 quart of 20 per cent salometer brine (2 ounces salt per quart of water). After 2 or 3 hours the brine is drained off. The cucumbers are rinsed in cold water and packed lightly into clean, dry jars. The onions may be placed at the top or mixed in with the cucumbers. The mustard seed is proportioned equally among the jars. The celery seed are tied in a bag and simmered for 20 minutes in the vinegar. The original volume of the

vinegar is restored by adding water. The vinegar is brought to boiling and the oil is slowly stirred in. The hot solution is filled into the jars. The jars are set in the water bath and heated to 180° F. for 15 minutes.

Pickled Onions

Onions for pickling should be small. They are most easily prepared by blanching before peeling. The length of the blanching period will vary according to relative amounts of onions and water in the blanching kettle. The object of blanching is to cook the onion through the skin and one layer of the onion. This usually requires from 1 to 2 minutes' exposure to the blanching water. The onions should be cooled at once in cold water. A sharp knife is used to remove a thin slice at the root of the onion and to loosen the skin which readily slips free, leaving the onion perfectly peeled. Blanching removes the general objection to peeling onions. There is little or no effect on the eyes and nasal passages of the operator.

The prepared onions are packed into jars and covered with a pickle solution made as follows. For each quart of prepared onions the following materials are required: 1 cup white vinegar, 2 cups water, ½ pound of sugar and 1 tablespoonful of mixed whole pickling spices. The spices are tied loosely in a muslin bag. The sugar is dissolved in the mixed vinegar and water. The spice bag is placed in the syrup and simmered in covered vessel for 40 to 60 minutes. The original volume is restored by adding water. The hot pickle solution is poured over the packed onions. The jars are partially sealed and processed in the water bath for 30 minutes. If a sweeter pickle is desired the onions may be handled in same way as given for water melon rind pickle. Onions may be fermented before they are pickled. (See Fermented Pickles.)

Green Tomato Pickles

The green tomatoes are washed, cored and cut into thin slices. To each 10 or 15 pounds 1 pound of onions, sliced thin, and ½ cup of salt are added. The tomatoes, onions and salt are mixed and allowed to stand overnight. The juice is drained from the vegetables after which the following materials are mixed with them: ½ lemon, sliced very thin, 3 medium size red peppers, chopped fine, 1 tablespoonful ground mustard, 3 cups good cider vinegar and the spice bag containing 1 tablespoonful each of whole black pepper, whole allspice, whole cloves and celery seeds. After thorough mixing the materials are boiled slowly for 30 minutes. The spice bag is removed, the hot pickle is filled into clean,

dry jars which are then partially sealed and processed in the water bath, pints 15 minutes and quarts 18 minutes.

PICKLE MAKING—OUTLINE

FRESH CUCUMBERS

<table>
<tr><th colspan="2">I. FERMENTED</th><th colspan="2">II. UNFERMENTED</th></tr>
<tr><td colspan="2">1. In 40 per cent salometer brine, 5–7 weeks. (Salt pickles or salt stock.)
2. Freshened in clear water.
3. In 2½–3 per cent vinegar, 2–3 days.
4. Vinegar restored to 2½–3 per cent acid.</td><td rowspan="2">A. Quick Process
1. In 40 per cent salometer brine overnight. (4 ounces salt per quart of water.)
2. Rinse in clear water.
3. Dilute vinegar, 2 parts vinegar, 1 part water. Sugar, 3½–4 pounds per gallon.
4. 2 ounces mixed spices per gallon added to solution 3, above.
5. Cucumbers heated in pickle solution for a few minutes at simmering point.
6. Packed loosely into jars and covered with hot solution. Seal at once.
7. Ready to eat within few days.</td><td rowspan="2">B. Slow Process
1. Washed cucumbers packed in following solution:
1 gallon vinegar
1 cup mustard seed
1 cup salt
1 cup sugar
2. Must be kept submerged by weight.
3. Will keep until early summer.
4. If acidity of vinegar is restored, 2 weeks after packing, will keep indefinitely.</td></tr>
<tr><td>A. Sweet Pickles
1. After 24 hours vinegar restored to 3 per cent acid. Stand 2–3 days.
2. Sugar, 2 pounds per gallon vinegar added.
3. After 3–5 days sugar increased to 4 pounds per gallon pickle solution.
4. After 3–5 days sugar increased to 6 pounds per gallon of pickle solution.
5. 2 ounces mixed whole spices per gallon of pickle solution added.
6. Ready to eat or pack after 1 week.

Note. Sugar may be increased or decreased.</td><td>B. Sour Pickles
1. After 2–4 days vinegar restored to 3½ per cent acid.
2. After 1 week vinegar restored to 3½–4 per cent acid.
3. Ready to eat or pack after 1 week.

Note. Spices may be added if desired.</td></tr>
</table>

Sizes of Cucumbers.—Both the length and the diameter are considered when grading cucumbers to size. The more nearly constant of

these two factors is length, and for that reason it, alone, is used as the basis for the classification which follows. Although there are rather wide variations with respect to numbers per gallon and uses, this grouping will be of interest to the small pickles maker and may serve as a reasonable guide in converting cucumbers into pickles and pickle products.

Size	Length in Inches	Number in One Gallon	General Use
Very small (Midgets or Gherkins).......	1 to 1¾	330 to 440	Sweet pickles
Small...............	2 to 2¾	100 to 220	Sweet pickles
Medium.............	3 to 3¾	50 to 80	Sour, dill pickles
Large...............	4 to 4¾	22 to 25	Dill pickles, cut pickles both sweet and sour
Very large...........	4¾ up	18 to less	Cut pickles, chow-chow, etc.

SAUERKRAUT

Sauerkraut is a fermented cabbage pickle. The fermentation is controlled by the addition of dry salt. The salt causes some of the juice to flow from the sliced cabbage. This juice dissolves the salt and a brine is formed which permits the desired fermentation to take place.

When making sauerkraut for home use earthenware jars of suitable capacity or kegs may be used as containers. The cabbage should be matured. All coarse leaves are removed and cabbage heads are washed. The solid portion of the heads is sliced or shredded, using either a kraut slicer or a sharp knife. The heavier part of the core and the coarse base of leaves are discarded.

The shredded cabbage is weighed and salt in the ratio of 4 ounces (½ cup) to 10 pounds is thoroughly mixed with the cabbage. The salted cabbage is packed firmly in the container. If preferred the cabbage and salt in the above ratio may be packed in alternate layers. When the container is packed to within 3 or 4 inches of the top the cabbage is covered with a clean cloth and a weighted cover—a plate or a board. The function of the weighted cover is to keep the cabbage submerged in the brine.

The container should be placed in a cool or moderately warm room 60° to 75° F. Fermentation will begin within a few hours as shown by rise of brine over the weighted cover. Active fermentation usually

continues for 10 to 20 days. When active fermentation ceases the brine settles back into the kraut and if much has been lost by evaporation enough weak brine, 1 ounce salt per quart of water, should be added to bring the level of the brine over the weighted cover.

The scum that forms on the surface must be removed every few days. When active fermentation ceases, the container should be moved to a cool room for ripening or curing. If the storage room is quite cool the sauerkraut may be left in the container by giving proper protection, that is, the weighted cover is removed and a layer of melted paraffin is poured over the kraut. This excludes the air and prevents growth of molds. If preferred the sauerkraut may be packed tightly into glass jars and enough kraut juice added to fill the jar. The jars are partially sealed and processed in water bath for 1 minute.

RELISHES

Relishes include a large group of vegetable products each having its own special characteristics. The line separating them from pickled vegetables is so obscure that some relishes are known as vegetable pickles. The one chief difference between the groups is that relishes seldom or never contain large pieces. They are pulpy as in ketchup, finely macerated as in horseradish or in finely cut pieces as piccalilli, pepper sauce, etc. Relishes resemble pickles in that vinegar and spices enter into their manufacture. Relishes differ widely in their composition, taste, and flavor. They may be named from the dominant vegetable in their composition as tomato ketchup or they may be given some special name as chow-chow or piccalilli.

Corn Relish

A good corn relish may be made from the following materials: 18 large ears of corn or 3 pounds of cut corn, 4 medium size onions, 1 sweet pepper and a 2- or 3-pound cabbage.

The corn is blanched 3 to 5 minutes in boiling water, cooled and cut from the cob in medium thick slices. The cabbage is cut fine with chopping knife—may be run through food chopper together with the peeled onions, using the medium coarse cutter. The chopped vegetables are placed in a pickle solution consisting of 1 quart of good cider vinegar, $\frac{3}{4}$ cup sugar, 1 tablespoonful of salt and 1 tablespoonful ground mustard. The relish is heated to boiling and boiled slowly for 20 to 30 minutes. The hot materials are filled into clean, dry containers. The jars are partially sealed and processed in the water bath, pints 5 minutes, quarts 8 minutes.

Beet and Cabbage Relish

The beets are blanched to remove the skins. They are then cut into ¼-inch cubes. The cabbage is cut fine. For each two cups of cut cabbage the following materials are required: 1 cup diced beets, 3 cups vinegar, 3 ounces salt, 3 ounces prepared mustard, 1 teaspoonful each ground cinnamon, allspice and pepper. The mixture is allowed to stand overnight. Next day it is packed into clean, dry jars. The jars are partially sealed and are processed in the water bath, pint jars 5 minutes and quart jars 8 minutes.

Chow-Chow

There is no standard for this product. Almost any mixture of vegetables preserved in a pickling solution might be qualified to be classed under this name. The following recipe may serve as a guide for those who know and appreciate a good mixed vegetable relish. All vegetables are chopped. If the vegetables are run through a food chopper the medium size cutter will give satisfactory texture. The proportions of vegetables given are measures of chopped vegetables: 1 quart green tomatoes, 1 quart green cucumbers, ½ cup green sweet peppers, 1 quart cabbage, ½ cup onions, 1½ quarts good cider vinegar, 1½ cups sugar, 2 teaspoonfuls each of following spices: celery seed, mustard seed, allspice, broken cloves and broken cinnamon bark. The chopped vegetables are mixed and allowed to stand overnight in a 20 per cent salometer brine (¼ cup salt per quart of water). The allspice, cloves and cinnamon are tied loosely in a muslin bag and simmered in the vinegar for 20 minutes. The original volume of vinegar is restored by adding water. The drained vegetables are added and boiled slowly until they are tender. The sugar is added and the material is boiled for 2 or 3 minutes. The hot mixture is packed into clean, dry jars and processed for 2 or 3 minutes in the water bath.

Cucumber Relish

The cucumber if sliced should be small (2 inches and under) if chopped they may be medium or above (up to 4 or 5 inches). The following materials are required for each 2 pounds of prepared cucumbers: ½ cup of chopped onions, 1 cup chopped sweet red peppers, ½ cup chopped green sweet pepper, 1 pint of good vinegar, ½ cup to 1 cup of sugar, 2 teaspoonfuls of salt and 1 teaspoonful each of following spices: mustard seed, broken cloves, broken cinnamon bark and allspice. The prepared vegetables are mixed and covered with a 20 per

cent salometer brine (2 ounces ($\frac{1}{4}$ cup) salt per quart of water). The following day the vegetables are drained from the brine and freshened for 2 or 3 hours in clear water. The water should be changed at least 2 or 3 times. The spices, except the mustard seed, are tied loosely in a thin muslin bag and simmered for 30 minutes in the vinegar. The original volume of vinegar is restored by adding water. The sugar and salt are dissolved in the spiced vinegar and it is poured over the drained vegetables. After standing for 24 hours the pickle solution is drained off in order to secure more uniform packing. The vegetables are then packed loosely into the clean, dry jar filling to within one-half inch of top. The pickle solution is concentrated by boiling to approximately $\frac{3}{4}$ cup for each packed pint jar or 1 cup for each quart jar. The hot solution is poured into the packed jar, filling them full. Care must be used to expel all the air. This is facilitated by stirring the contents of the jars. If the level of the liquid falls below one-quarter inch of top the jar should be refilled. The jars are partially sealed and processed in water bath, both pints 10 minutes, quarts 12 minutes.

Dixie Relish [1]

All vegetables are chopped. The chopping knife requires more labor but produces a somewhat better product. The food chopper may be used. The medium coarse cutter is best. For each quart of cabbage the following materials are required: 1 pint sweet red peppers, 1 pint sweet green peppers, 1 pint onions, $\frac{3}{4}$ cup sugar, 4 tablespoonfuls salt, 1 quart good cider vinegar, and 2 tablespoonfuls each of mustard seed and celery seed. The peppers are cut into halves and stems and seeds are removed. They are usually allowed to stand overnight in 20 per cent salometer brine ($\frac{1}{4}$ cup salt per quart of water). They are then taken from the brine and freshened by standing one-half hour each in 3 changes of clear water before they are chopped. The vegetables and spices are thoroughly mixed, the vinegar and salt are added and the mixture is allowed to stand for one day. The materials are packed into clean, dry jars and processed at 180° F. for 15 minutes.

Pepper Hash

A small batch of this relish is made from the following materials: 2 pounds green sweet peppers, 2 pounds ripe sweet peppers, 3 pounds onions. The seeds are removed from the peppers, the skins from the onions and all are run through the food chopper, using the medium

[1] Pearl Jones Haak, Extension Service, The Alabama Polytechnic Institute Cir. 102.

coarse cutter. The mixed vegetables are covered with boiling water. After five minutes they are drained and covered with a mixture of vinegar and water ($\frac{1}{2}$ vinegar and $\frac{1}{2}$ water). The mixture is brought to the boiling point, the liquid is drained off and vegetables pressed lightly to remove excess of solution. The drained vegetables are covered with the pickle solution made by dissolving 2 cups sugar and 2 tablespoonfuls of salt in 1 pint of vinegar. The vessel is set over the fire and heated slowly to the boiling point. The hot material is filled into clean, dry jars, the jars are partially sealed and processed in the water bath, pints 5 minutes and quarts 8 minutes.

Piccalilli

There are many ways of mixing vegetables to make piccalilli. The following may serve as a guide to the beginner. One-half peck of green tomatoes, 1 pint medium or small cucumbers, 1 medium size green sweet pepper and 2 medium size onions. All vegetables are thoroughly washed. The tomatoes are cored and cut into chunks, the stems and seeds are removed from the pepper, the onions are peeled, and quartered; all vegetables are run through the food chopper using the medium size cutter. One-fourth cup of salt is mixed with the chopped vegetables and they are set aside for 10 to 12 hours. After standing the juice is drained off and pulps lightly pressed to free them from excess liquid. The drained vegetables are next placed in a pickle solution made by dissolving $\frac{1}{4}$ pound of sugar in 1 quart of good vinegar and adding 1 teaspoonful each of mustard seed, celery seed and whole cloves. The materials are mixed thoroughly and heated to boiling. The hot product is filled into clean, dry jars which are then partially sealed and processed in water bath, pint jars 5 minutes and quart jars 8 minutes.

Pottsfield Pickle

The materials may be chopped fine or they may be run through a food chopper, using the medium coarse cutter. After chopping the materials are mixed in the following proportion: 3 pints of green tomatoes, 3 pints of ripe tomatoes, 3 pints of onions, a good sized plant of celery, and 4 medium sized ripe peppers. To these $\frac{1}{2}$ cup of salt is added, thoroughly mixed and after standing 24 hours the juice is drained off. To the drained vegetables there is added 1 quart of good cider vinegar, 1 pound of sugar, 1 teaspoonful each of ground cinnamon and cloves, $\frac{1}{2}$ teaspoonful ground mustard. After thorough mixing the material is boiled at moderate rate for 20 minutes. The hot pickle is filled into clean, dry jars and sealed.

Ripe Tomato Products

The common relishes made from ripe tomatoes are chili sauce and ketchup. These are successfully made in the home, using small quantities of materials. There are many combinations of vegetables recommended and the kind and amount of spices have a wide range. The directions given for these two products have given satisfaction to many consumers.

Chili Sauce

The tomatoes should be sound and well ripened. They are washed, blanched to remove skins and cored (see page 93). They are then cut into suitable sized pieces to run through the food chopper using the medium coarse cutter. For each gallon of chopped tomatoes the following vegetables chopped medium fine are used: 1½ cups each, ripe sweet peppers and green sweet peppers, and 1 cup of onions. To these chopped vegetables are added 2½ tablespoonfuls of salt and the spice bag containing 2 tablespoonfuls ground cinnamon and 1½ teaspoonfuls each of ground cloves and allspice. The vegetables are boiled moderately to rapidly with sufficient stirring to prevent burning until reduced to about three-quarters of the original volume. At this time 1½ cups of standard vinegar of good flavor and ¾ to 1 cup of sugar are added. Rapid boiling is continued until of desired consistency, that is, there should be little or no free liquid. This will require concentration to a little more than one-half the original volume.

The finished sauce is filled into clean, dry containers and processed in the water bath for 5 minutes.

TOMATO KETCHUP

The tomatoes should be sound and well ripened. They are thoroughly washed and cut into slices or chunks, to each pound of prepared tomatoes one-half cup chopped onions are added. The vegetables are heated slowly until the juice runs freely and are then boiled moderately with stirring to prevent burning until the tomatoes are in pieces or for 5 to 10 minutes. The pulps are forced through a fine sieve to remove seeds, and skins and to give a fine even texture. If the boiling has not been too rapid there should be about 1 gallon of pulp for each 10 pounds of tomatoes. The spice bag, containing 1 teaspoonful of ground cinnamon and ½ teaspoonful each cloves and allspice, is added and the pulp is boiled at moderate rate, being stirred sufficiently to prevent burning, until reduced to approximately 2½ quarts. At this time 2 cups of vinegar, 1 cup of sugar and 3 tablespoonfuls of salt are

added. Boiling is continued until the pulps contain no free liquid. This will require concentration to a little less than half the original volume of tomato pulp. The color is greatly improved if 2 teaspoonfuls of paprika are added about 5 minutes before finishing.

The spice bag is discarded and the hot ketchup is filled into clean, dry containers and sealed at once.

STANDARDIZATION OF VINEGAR

The Pearson's Square, which was formulated for the purpose of standardizing cream, is equally applicable to the standardization of vinegar. In preparing a vinegar of desired acidity one or two other facts are necessary. If a strong vinegar is to be reduced by the addition of water the acidity of the vinegar must be known. If, however, two vinegars—one of low and one of high acidity—are to be blended to make one of medium acidity the acid content of both vinegars must be known.

The method of determining the ratio in which two vinegars of known acidity are to be mixed to give a vinegar of desired acidity is as follows: the figure indicating the acidity of the desired vinegar is placed in the center of a square while that of the strong vinegar is placed at the upper left-hand corner and that of the weak vinegar at the lower left-hand corner. Subtraction is made diagonally across the square, always subtracting the less from the greater and the result is placed at the right side of the square. The figures at the right side of the square will indicate the ratio in which the two given vinegars are to be mixed to form a vinegar of desired acidity. Example: suppose a 3.5 per cent vinegar is desired. The vinegars available are 1.5 and 4.5 per cent, respectively. When these figures are arranged as given above and the proper subtractions are made the results show it will require 2 parts of the 4.5 per cent vinegar and 1 part of the 1.5 per cent vinegar.

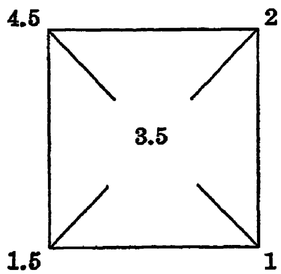
If water is used to reduce a strong vinegar the figure at the lower left corner will be 0. If a definite amount of the desired vinegar is required the exact amounts of the vinegars forming the mixture may be determined by adding together the figures at the right of the square. This gives numerically the number of parts required which in the case above is 3. This number then serves as a denominator of a common fraction and the numbers at the right are the numerators. Applying this principle it is found that the new vinegar is made up of $\frac{2}{3}$ strong vinegar and $\frac{1}{3}$ weak vinegar.

Testing Vinegar.—Vinegar is tested by the usual method of titration, using $\frac{1}{10}$ normal solution of sodium hydroxide with phenolphthalein as

an indicator. The method is as follows: A measured amount of vinegar, usually 3 cubic centimeters, are placed in a small beaker. To this is added 50 to 100 cubic centimeters of pure water and a few drops of indicator. The beaker is set under the burette containing the tenth normal sodium hydroxide. This alkali is allowed to flow slowly into the beaker until a distinct pink color is formed and which will remain for at least one-half minute. If the contents of the beaker are kept well stirred the end point is readily detected. The burette reading is made at the beginning and close of the operation. The difference between these readings is the number of cubic centimeters of alkali required to neutralize the acid in the vinegar. By substituting in the following formula the per cent of acid in the vinegar may be determined. See Appendix A, for method of deriving the formula,

Fig. 39.—Testing vinegar by method of titration, using the "Brook's tester."

$$\frac{\text{cubic centimeters of NaOH} \times .006}{\text{cubic centimeters of vinegar}} \times 100 = \text{per cent of acid.}$$



The Pearson's Square

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CHAPTER XIX

BEVERAGES AND SYRUPS

Fruits form the basis for many healthful, refreshing beverages. These, as a rule, are of more food value than the "tonics" and soda waters sold in the market. They not only contain all the food elements found in such carbonated drinks but in addition they have some organic salts and the water-soluble vitamins.

Beverages made from fruits are not easily classified since different names are applied to the same beverage, thereby leaving no legitimate basis for classification. Any reasonable grouping of these would demand the elimination of names long applied to some one or more particular fruit drinks.

The taste of all fruit beverages should be sub-acid to tart. The sugar content should not exceed 10 to 15 per cent, preferably not more than 10 per cent; and the acid content may vary from 0.6 to 1.0 per cent. It is a mistake to add a large amount of acid to a drink of high sugar content for the purpose of giving it an acid taste. Such drinks are cloying to the appetite and do not satisfy the thirst. The heavy sugar beverages should be diluted with water until the sugar content is within the given range, then tartaric or citric acid added to suit the taste. Lemon juice is often used as the very common substitute for the pure acid.

FRUIT JUICES

A fruit juice intended for a beverage may be obtained by cooking the fruit and pressing out the juice, or the fresh fruit may be crushed or grated and the juice obtained by pressure. The color of the fruit juice should be characteristic, clear and free from sediment. The taste should be sub-acid to tart with aroma and flavor of the fruit retained.

Most fruit juices are obtained by cooking the fruit. The most notable exceptions are cider (see page 229), perry—the juice of the pear, and the citrus fruit juices. The fruits most commonly used for making juices by the cooking method are blackberries, currants, grapes, loganberries and raspberries.

The cooking temperature of the fruits should not be above 175° F. nor lower than 160° F. High temperature imparts an undesirable cooked flavor. Lower temperature may cause a precipitate during pasteurizing if the temperature of the water bath should exceed that at which the fruit was cooked.

Cider

See Chapter XXI, Cider Products.

Grape Juice

The fruit should be fully ripened. The berries are removed from the clusters, washed, and drained. The fruit is weighed and placed in a cooking vessel. Water is added at the rate of 1 cup for each 5 pounds of prepared fruit. Heat is applied slowly until the temperature reaches 165° to 170° F., and is maintained at that point until the berries become somewhat soft (10 to 12 minutes). The vessel is removed from the fire and allowed to stand for 5 minutes. All free-run juice is strained off through one layer of cheesecloth. The pulps may be recooked to make jelly, or they may be made into butter, or all juice possible may be pressed from them, after which they are discarded.

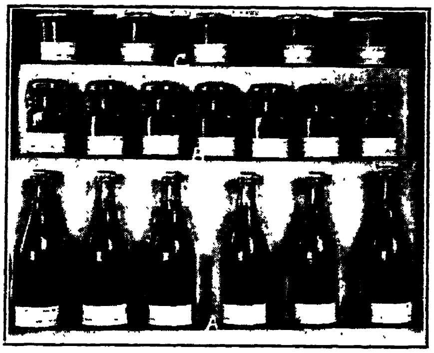

Fig. 40.—Products made from ten pounds of grapes

A, grape juice; *B*, grape butter; *C*, grape jelly.

The extracted juice is clarified by straining through four layers of good cheesecloth. As a general rule two to four ounces of sugar per quart are added to improve the taste and to facilitate the clarifying process. The juice is then filled into clean, dry containers, preferably the largest available, and is pasteurized at 170° F., quarts 25 minutes, 2-quart jars 30 minutes, 4-quart jars 45 minutes. After standing for some weeks the argol crystals and suspended pulp will have settled to the bottom of the containers. The clear juice may then be drained from the sediment, filled into clean containers and pasteurized at 170° F., pints 20 minutes, quarts 25 minutes. This juice should keep for months and should be free from sediment or crystals.

If the juice is for home use the second pasteurizing may be omitted. The sweetened juice is filled into desired size containers and pasteurized. In serving this juice the clear liquid is carefully poured

off, leaving the sediment in the jars; or the juice may be strained through several layers of cheesecloth.

Grape juice made as directed will have good color, will be sub-acid in taste, highly aromatic and of excellent flavor. It is practically a pure juice and may be diluted with water when served.

Grape Ade

Many prefer this highly aromatic less concentrated form of grape beverage. It is prepared as follows: A heaping cup of well-ripened grapes and $\frac{3}{4}$ cup of sugar are placed in a quart jar which has been boiled for 2 or 3 minutes and which has just been removed from the hot water. The jar is then filled to the top with boiling water and the jar sealed immediately. The jar is laid on the side for 10 minutes before standing upright. A variation of this method is to place the grapes, sugar and either warm or cold water in the jars which are partially sealed and place in the water bath. The water is heated to boiling and the fire is removed. After standing for 15 minutes the jars are removed and sealed. The beverage is ready to serve after standing for 2 or 3 weeks.

Other Fruit Juices

Blackberry and raspberry juice may be prepared in the same manner as given for grape juice. In this case, however, there will be no crystals formed. Any sediment found on the bottom of containers is the finely divided pulp which was not removed by straining. These fruits, being less acid than grapes, will require less sugar. The color of the red raspberry will not stand up as well under storage as that of the purple and black sorts.

FRUIT SYRUPS

There are two classes of fruit syrups: (1) Those made by neutralizing the acid in a fruit juice, followed by concentration by boiling; and (2) those made by addition of sugar to a fruit juice. Syrups in group 1 are relatively unimportant, but those of group 2 are of great commercial value. Syrups are used as a base for beverages, dressing for ice cream, pudding, etc.

As a general rule the sugar content is around 60 per cent and when the syrups are used with ice cream, etc., they are sufficiently sweet. But when used as a beverage they must be diluted by adding three to five volumes of water, depending somewhat upon the acidity of the fruit as well as upon its taste and flavor. Those made from the less

acid fruits will require additional acid, which may be added in the form of lemon juice.

Method of Manufacture.—The general method of procedure is as follows: The juice is extracted from the fruit in the same manner as for making jelly. The juice is clarified by straining through four layers of cheesecloth. It is then concentrated by rapid boiling to approximately 1 pint per pound of fruit. This juice is again clarified through four layers of cheesecloth. Sugar is added in the ratio of 1¼ pounds for each pint of concentrated juice. The syrup is brought to the boiling point and filled into clean, dry containers. The jars are partially sealed and processed in water bath, pints 5 minutes. Bottles are set in the water bath with water to within one inch of the top and processed, pints 5 minutes. The bottles are removed from the bath, capped or corked at once, and laid on the side to cool.

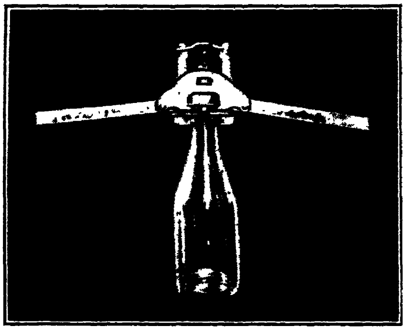

FIG. 41.—A small, efficient bottle capper.

The fruits best adapted for making syrups are blackberries, sour cherries, cranberries, currants, peaches, pineapple, raspberries, and strawberries. Cranberry is likely to cause trouble by precipitating a large part of its pectin. This may be overcome to some extent by less concentration of the juice or by reducing the sugar to 1 pound per pint of juice.

Special Methods.—A few fruits such as the cranberry, peaches, and other stone fruits will give more satisfactory results, if they are given special treatment.

CRANBERRY SYRUP

Cranberry syrup of good color, excellent flavor and practically free from precipitate may be made by the following method. The cleaned berries are placed in shallow pans, in small lots of 1 or 2 quarts. A syrup is made by heating to solution 1¼ pounds of sugar and ¾ cup of water per quart of fruits. The hot syrup is poured over the berries and the pans are placed in a steamer and steamed at boiling temperature for 45 minutes. The pans are removed from the steamer and are allowed to stand in a dry room for 2 or 3 days. The fruit should be stirred a few times each day. Then the pans are set over the fire again and heated to 160° to 180° F. in order to facilitate straining. The

syrup is strained through a single layer of cheesecloth. The pulps may be pressed and then used with other fruits to make a cheap jam or marmalade, or the free-run juice only may be strained off leaving the cranberries whole, which may be canned and used as a jam. The strained juice is clarified by straining through two layers of cheesecloth, after which it is bottled as described in the general methods.

Peach Syrup

Peach syrup is prized for both the fruit flavor and the almond flavor of its pits. This combination of flavor is obtained by the following procedure.

The fruit should be ripe, preferably soft-ripe. The peaches are washed to remove dirt and fuzzy bloom. They are halved and pitted. The halves are cut into thin slices and cooked at slow boiling, in water, 3 cups per pound of fruit, in a covered vessel for 45 minutes. The pits are broken, the kernels are mashed or cut into several pieces. To the crushed pits from 1 pound of fruit 1 pint of water is added and they are cooked, at slow boiling, in a covered vessel for 1 hour. The juice is strained from the fruit and concentrated, by rapid boiling to 1½ cups. The water is strained from the pits and is concentrated to ½ cup. This extract is added to the juice from the fruit. The mixture is clarified by straining through four layers of cheesecloth. The clarified juice is heated to boiling and 1 pound sugar per pint is added and stirred to solution. The syrup is allowed to come to the boil and is then bottled as given under general method.

Note.—If the peach syrup is to be used in a highly diluted mixture as for flavoring ice cream or a punch the natural almond or pit flavor may be intensified by adding 1 tablespoonful of extract of bitter almonds to each quart of peach syrup. The extract should be added just before the syrup is bottled.

Choke Cherry and Wild Cherry Syrup

These fruits have a bitterish astringency which many people like. The syrups are made as directed under Peach Syrup. A less astringent syrup may be made if pits are not broken. Syrups from these fruits are used sparingly in mixtures of other syrups or juices in order to impart to the mixture the desired amount of taste and flavor of the wild cherry.

The cultivated sour cherries will produce a syrup quite similar if the pits are broken and the syrup made as described under Peach Syrup.

Plum Syrups

These may be made in the same manner as described under Peach Syrup.

Punch

Almost any mixture of fruit juices sweetened to taste and used for a drink is called a punch. Obviously then there is an almost countless number of possible combinations.

The outstanding characteristics of a good punch are: (1) it has attractive color, (2) relatively low sugar content, (3) sugar-acid ratio such that the taste is distinctly tart and (4) is chilled to a temperature near melting point of ice.

The flavor and aroma, which are very important, are determined by the materials used and the length of standing after mixing. The flavor may be mainly that of one fruit blended with others or it may be a pleasing equal blend of two or more fruits.

A punch may be clear, containing no visible pieces of pulp. It may have considerable amount of finely divided pulp in suspension or it may even contain small bits or pieces of fruit such as strawberry or maraschino cherries.

M. A. C. Punch

Materials	Amount Expressed as Part of Mixture	Amount to Make One Gallon, No. of Cups
Grape juice	1/5	3
Raspberry juice	1/10	1 3/4
Orange juice	1/20	3/4
Lemon juice	1/20	3/4
Sugar	1/20	3/4
Water	3/5	9

The above materials are mixed and strained through 2 layers of cheesecloth to remove all suspended pulp. Should be served ice-cold. When freshly made the flavor is a pleasing blend. After standing it becomes rather distinctly grape flavor blended with the raspberry and orange.

Cider Punch

To each quart of sweet cider the following materials are added, ½ cup raspberry juice, ¼ cup lemon juice, ¼ cup orange juice, 1 cup sugar,

and 3 or 4 cups water. The mixture is strained to remove all suspended pulp. It should be served ice-cold.

VINEGARS AND SHRUBS

These two terms are used practically interchangeably in the literature. These beverages are characterized by the presence of vinegar. Properly applied the term vinegar as related to a fruit drink is one in which the vinegar is the natural product of fermentation, whereas the term shrub would apply to those beverages to which vinegar is added during the process of manufacture.

Vinegars are made by extracting the juice from the fruit and allowing it to ferment to form vinegar, that is, the sugars are changed into acetic acid by a double fermentation process. The fruit vinegar produced in this manner is sweetened to taste and is used for beverage purposes.

Shrubs are made by extracting the juice and adding sugar and vinegar—usually cider vinegar; or the fruit is crushed, the vinegar added, and after 24 to 48 hours the liquid is strained from the pulps, sweetened with sugar and used for beverage purposes usually by diluting with water. Lemon juice may be substituted for the vinegar if vinegar flavor is objectionable. It will generally require about twice as much lemon juice as vinegar.

Raspberry Shrub

If the fruit is to be cooked the procedure is as follows: The berries are weighed, washed and drained well. They are then placed in a cooking vessel, crushed, and ½ cup of water is added for each pound of fruit. Heat is applied to bring the temperature to 175° to 180° F. for 10 minutes. The vessel is removed from the fire and allowed to stand for 5 minutes. The juice is strained off through one layer of cheesecloth. The pulps are pressed to obtain all the juice possible. The juice is clarified by straining through four layers of cheesecloth. The clarified juice is measured and to each pint is added 2 to 3 ounces or ¼ to ⅓ cup of well-flavored vinegar and ½ pound of sugar. The sugar should be added while the juice is warm and stirred to solution. The vinegar is preserved by filling into clean, dry jars, partially sealing and pasteurizing them for 20 minutes at 175° F. When used, it should be diluted with water and chilled with ice.

If the shrub is to be made by the uncooked method the procedure is as follows: The prepared fruit is placed in an earthenware or enameled

vessel and thoroughly crushed. Vinegar is added at the ratio of ½ cup for each quart of berries. The vessel is allowed to stand for 2 or 3 days, being stirred a few times each day. When standing period is over the juice is strained off and the pulps are pressed. The juice is then clarified by straining through four layers of cheesecloth. Sugar is added at the ratio of ¾ pound per pint of clarified juice and stirred to solution. The resulting vinegar is preserved as described above.

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CHAPTER XX

MAPLE PRODUCTS

The manufacture of maple products is carried on in restricted areas only. However, the student of food preservation should find an academic if not a practical interest in a brief discussion of this important industry.

Tradition and history both tell us that the art of utilizing the sap from the maple tree was known to the Indians of the New England section long before its occupation by the whites. A legend is current which purports to explain the discovery of the art of making maple syrup.

A squaw was one day heating the sweet water obtained from the maple tree, in which she intended to cook meat. At the same time she was finishing a pair of fancy moccasins for her husband, a mighty chief, who at the time was absent on a hunt. Like many of her modern white sisters she became so absorbed in her fancy work that she forgot her cooking. The result was that the vessel boiled almost dry and the meat had not been put over the fire. Hearing her husband approaching and in fear of his wrath upon finding no dinner she fled to the woods for safety. The warrior returned and approached the spot where his dinner should have been cooked. There was no meat in the vessel—only a dark-reddish liquid. Curiously he dipped a finger into it and tasted what adhered. He was so pleased and delighted with the result that before stopping he had emptied the vessel. Overjoyed he went in search of his squaw and finding her, praised her for the delicious feast she had provided. Later he reported to the tribe that a special messenger from Manitou had come to earth to teach his squaw the secret of this wonderful new thing. Such being the legend that has come down to us, it is assumed that the happy wife exercised the required discretion regarding the episode.

However much of truth there may be in this legend the fact remains that records made by the earliest white men in New England contain reference to the use of maple sugar or to its method of manufacture. There is no reason to doubt that the white settlers learned the art of syrup and sugar making from the Indians.

Location of Industry.—Practically all the maple syrup is produced in the northern half of the United States westward to the Mississippi Valley and in southern Canada. The commercial area is included in New England, New York, Ohio, Pennsylvania, Maryland, Michigan, Minnesota, Wisconsin, and Indiana. In Canada the commercial area comprises Quebec, Ontario and the provinces along the Atlantic Coast.

Early Manufacture.—The first manufacturing processes used by white men were primitive and crude. The trees were tapped by cutting

Fig. 42.—The maple trees along the New England highways contribute much toward the supply of maple syrup and maple sugar.

a notch in them with an ax. A thin piece of wood or bark was fastened into the notch which conveyed the sap to the vessel on the ground below. The sap was boiled down in large iron kettles over an open fire, being replenished with fresh sap when it had boiled low. The natural result of long boiling and admixture of foreign material was a dark-colored syrup with a pronounced caramel flavor.

Modern Methods.—Under modern methods every precaution possible is taken to avoid contamination of the sap. The buckets are covered; the sap is strained and evaporated as rapidly as possible into syrup. Such manipulation produces a syrup very light in color, of

exceptional maple flavor and with aroma unobscured by presence of any foreign flavor.

The watchword of the successful manufacturer of maple products is cleanliness. All vessels that come into contact with the sap are kept scrupulously clean. The sap buckets are brought in once or twice during the season and given a thorough cleansing. They are scalded and washed and in addition some give them an antiseptic bath. Hypochlorite of lime is frequently used. It is an excellent germicide and will leave the sap equipment thoroughly sterile and harmless from the human food standpoint. Some even wash out the tap holes with this disinfectant, reducing the possibilities of fermented sap to the lowest possible minimum. The gathering buckets and tanks are also treated. The cause of off-flavored sap at the close of the season is due entirely to bacterial contamination of the sap. If all equipment is kept clean and free from bacterial fermentation the last-run sap will give a good-flavored syrup and as well colored as that from the first-run sap.

The manufacture of maple syrup, which is the basis of all maple products, consists essentially of two operations: (1) securing the sap and (2) concentrating the sap to syrup.

Securing the Sap.—Sap as it comes from the maple tree is a clear, sparkling, colorless liquid with a sweet taste and a pleasing flavor. The sugar content varies from 1.5 up to 4 or 5 per cent. The general average is 2.5 to 3 per cent. In addition to sugar there is also a trace of organic salts and some albuminous materials. The period of sap flow varies with the location, also from year to year. In central New England the sap flow may be expected to begin any time from the latter part of February to the middle of March. Further north the season is later while south it will be earlier. The sap flow is very closely related to the weather conditions; depending on the weather the season may last two to four weeks. Ideal weather conditions consist of cold nights with the temperature going a few degrees below freezing followed by warm days in which the temperature runs a few degrees above the freezing point. Cold northerly winds even though the thermometer records a thawing temperature tend to reduce the flow. A period of two or more days with the temperature above or below the freezing point will stop sap flow.

Tapping the Trees.—Tapping is now done with a $\frac{3}{8}$-inch bit. The hole should be 2 to 4 feet above the ground, $2\frac{1}{2}$ to 3 inches in depth, and should slope slightly upward. The bit should be sharp in order to get a clean-cut hole. All chips should be removed. Any loose bark around the hole should be knocked off.

The Spout or Tap.—Many types of spouts are to be had. They should be of metal, preferably galvanized iron. They should be perfectly round and lightly tapering in order to fit tightly in the hole. The spout should carry a hook or lug upon which the bucket may be hung.

Buckets.—The day of the old wooden sap bucket has passed. Metal buckets, preferably galvanized iron, of 12 to 16 quarts capacity, are now most generally used in commercial work. These buckets have a hole in the side near the top through which the hook or lug on the spout passes when buckets are " hung."

Covers.—Covers are very essential. They keep out the rain and the snow; also a great amount of bark, twigs, etc. There are two

Fig. 43.—Types of sap buckets. Left to right, wood bucket of early days, modern galvanized iron bucket. The rapidly disappearing tin bucket.

general types: (*a*) those attached to the spout and (*b*) those attached to the bucket. Each type has its good points and both are efficient.

Gathering the Sap.—The sap should be collected frequently, preferably each day. The collecting tank may be of the ordinary commercial type, or barrels may be used for this purpose. Collecting tanks of various shapes and sizes are available. The operator must judge which type and size best serves his needs. As the sap is transferred from the buckets to the collecting tank it should be strained by pouring through a double layer of cheesecloth spread over the opening into the tank. This removes all the bits of bark, insects, etc., before the sap reaches the storage tank.

Storing the Sap.—A storage tank is necessary to keep the evaporator operating constantly over a period of good sap flow. Since sap spoils

easily, especially in warm weather, storage should be only temporary. The storage tank should be in the shade and should be elevated so that the sap may feed into the evaporator by gravity. If sap must be held longer than 24 hours in weather above freezing, ice should be added to it to keep the temperature down.

Concentrating the Sap to Syrup.—The evaporating equipment consists of two essential parts: (*a*) the sap or syrup pan and (*b*) the firebox or furnace. The syrup pan is made of heavy block tin or of galvanized iron, preferably the former. It is divided into a number of compartments so arranged that the sap must flow back and forth across the pan

Fig. 44.—Collecting maple sap.

gradually becoming more concentrated as it nears the exit point. In order that the greatest heating surface possible shall be available the bottom of the pan is corrugated.

The firebox may be of iron or of brick or stone. It is so constructed that the fuel burned at the forward end will heat the pan fairly uniformly throughout its length. Various dampers are used to control the heat. The fuel should be seasoned and dry. Soft wood or soft and hard wood mixed is preferable to all hard wood. Within very recent years a new type of evaporator has been introduced. In the new type the heat is derived from steam coils on the bottom of a specially constructed pan. The steam is generated in a boiler. The advantages claimed for this type of equipment are: more rapid concentration, more

uniform boiling, and elimination of danger of burning or scorching the syrup.

Boiling the Sap.—The rate of concentrating the sap should be as rapid as possible. The inflow of sap should be so regulated, if not automatically controlled, as to maintain a depth of not more than one inch above the corrugations on the bottom. The smaller the volume consistent with safety the shorter boiling period and the better quality of the finished syrup.

During the initial stages of boiling, a large amount of scum is

FIG. 45.—An inexpensive method of unloading sap.

The wagon is driven on to the elevated drive *A* and the sap flows by gravity into the outdoor storage tank *B*.

formed due to coagulation of albuminous materials. This should be removed. Careful removal of all scum during earlier stages of boiling leaves little or no skimming during the last stage.

Clarifying the Syrup.—As the sap nears the concentration of syrup it becomes supersaturated with the mineral materials and these will be deposited on the bottom and sides of the evaporator. When the syrup is drawn off it carries a relatively large amount of the mineral materials (sugar sand) in suspension. The hot syrup as it comes from the evaporator flows through a filter bag which removes all material in suspension. As the syrup cools there will be a further deposit which forms a fine sludge on the bottom of the container. The more careful

syrup makers draw the hot syrup from the evaporator through a filter bag into some convenient vessel where it is allowed to clarify itself further by sedimentation. This clear syrup is then standardized and filled hot into clean, dry containers. Usually these are sealed while hot. Sometimes the containers are given a short processing in the water bath before sealing.

The Finish Point.—The boiling point of a good maple syrup is 219° F. at sea level. This is 7° above the boiling point of water. In order then to determine the boiling or finish point of maple syrup at any elevation determine the boiling point of water and add 7° which

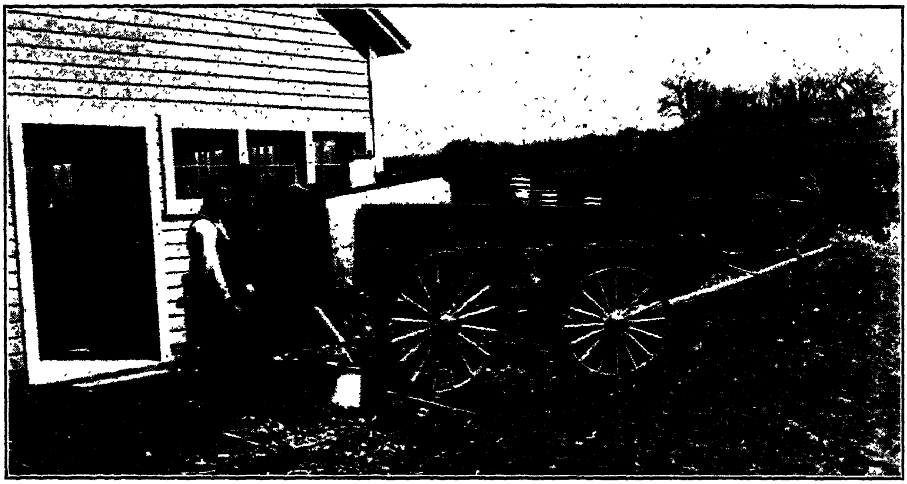

FIG. 46.—Expensive method of unloading maple sap.

The sap is run into buckets then carried into the room and emptied into the storage tank.

will be the correct temperature at that elevation. Another means of testing and the one used most by New England manufacturers is the Baumé hydrometer. Dealers in maple syrup equipment supply these instruments with a red ring marking the reading of both boiling hot and cold syrup.

Standard Syrup.—A syrup which boils at 219° F. at sea level, and which tests by the Baumé hydrometer 30½° hot or 35½° cold will weigh 11 pounds per gallon and is approximately 65 per cent sugar. This is a legal standard gallon in the United States. Its specific gravity is 1.32.

MAPLE SUGAR

The process of converting maple syrup into sugar is generally called "sugaring off." The temperature to which syrup should be boiled

to produce sugar varies so widely depending upon the syrup itself and the elevation that only a general range may be given. This range is from 232° to 240° F. or 20° to 28° F. above temperature of boiling water. The sugar maker should determine his own temperature within this range. Several kinds of sugar are made.

Cake Sugar

This is the large commercial cake which rarely, if ever, is seen on the retail market. It is produced by the maple sugar manufacturer to be sold to the wholesale trade.

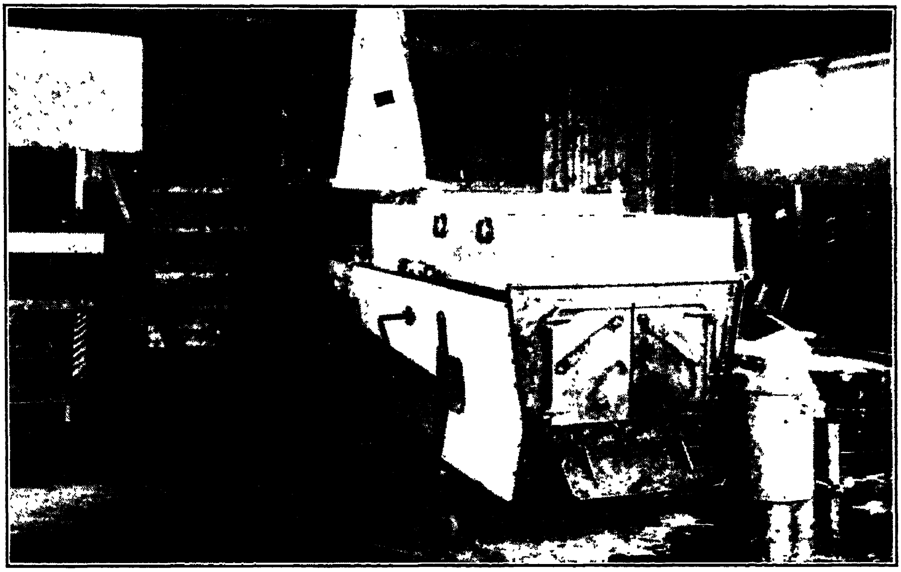

Fig. 47.—Interior of a farm maple syrup plant.

The syrup is boiled to the proper temperature. It is then removed from the fire and stirred or beaten until it becomes granular, at which time it is quickly poured into the molds. When cold it is removed from molds and stored.

Wafer Sugar

This is the type of maple sugar sold on the market and made in the homes. Its principal use is as a confection.

The syrup is boiled to the proper temperature, 232° to 234° F. (20° to 22° F. above boiling temperature of water). The syrup is then allowed to cool before beating. The temperature at which beating or stirring begins influences the size of the crystals, also the color. If

stirred immediately upon removal from the fire it is very coarsely granular and quite dark in color. If cooled to 120° F. before stirring, the crystals are very fine and the color very light, and the cakes are soft, almost plastic. A stirring temperature of 140° to 150° F. will usually give most satisfactory results. The cooled syrup is stirred until it becomes granular, at which time it is quickly poured into molds. These may be of metal or of rubber. A gallon of syrup will yield 8 pounds of wafer sugar. This sugar is approximately 15 per cent water.

Tub Sugar

Tub sugar is soft and moist. It contains 15 to 20 per cent of moisture and is rather coarsely granular. It is a popular and a standard product in certain parts of New England. The syrup is boiled to 230° to 235° F. (18° to 23° F. above temperature of boiling water) and stirred until granular. It may be stored in pails or tin cans. Color is usually darker than that of wafer sugar.

OTHER MAPLE PRODUCTS

Maple Cream

Maple cream is used as a confection and for icing cakes. Its consistency is heavy, cream-like, or soft cheeselike. The color is white or creamy yellow. Its texture is smooth, even and free from perceptible sized crystals.

The syrup is boiled to 228° to 230° F. (16° to 18° F. above temperature of boiling water) and allowed to cool undisturbed to 90° F. Vigorous stirring converts this heavy waxy syrup into the cream described above. The finished cream may be stored in jelly glasses.

Maple cream tends to revert in part to syrup. After standing for some time small reservoirs of syrup may form in the cream. As a general rule only a small amount is found in each package. When used it may be stirred into the heavy cream.

Maple Wax

Maple wax is not a stable product. It must be consumed almost as soon as made or held at freezing temperature. When maple syrup, heated to the "sugaring off" temperature, is chilled very suddenly by pouring small quantities, at a time, on packed snow or ice it forms a wax. This is one of the most delicious of the maple products. No "sugar eat" would be complete without its maple wax and accompanying sour pickles and doughnuts.

Yields

Since both the sap flow and its sugar content vary from year to year only close approximations of yield of maple products per tree are possible. Also large trees often carry as many as three or four buckets while small trees have a single bucket. On the basis of taps, the yield varies from 15 to 25 gallons per tap, an average of approximately 20 gallons per bucket. The amount of syrup which this average yield of sap will produce varies from $1\frac{1}{2}$ to $2\frac{1}{2}$ quarts, or an average of 2 quarts per tap.

Sap Flow

Many years ago the Vermont Experiment Station did a fine piece of work relating to sap flow. The following is an adaptation from their publications on this subject:

Structure and Physiology of the Tree.—The tree trunk comprises two essential parts: The heart-wood which is dead and the primary function of which is strength, and the sap-wood which surrounds the heart-wood and which contains living cells. The inner rings of the sap-wood are gradually merging into heart-wood as new rings of sap-wood are being formed on the outer side from the cambium layer just underneath the inner bark. This sap-wood is the natural channel through which the sap of the tree circulates. It is also the chief storage place for excess foods.

Manufacture and Storage of Carbohydrates.—The manufacture of carbohydrates takes place in the green leaves. It is transformed into soluble form—sugar—and transported by the sap to the parts of the plant where growth is taking place. The excess food is stored for the early spring growth. The excess carbohydrates not needed for present year's growth are stored chiefly in the sap-wood. The outer cells and fibers are filled first. The nature of this stored food is not thoroughly understood but a large part is believed to be starch.

Sap Pressure and Flow.—The rise of sap from the absorbing roots is greatest when trees are in full leaf. This may be due in part to suction caused by the rapid transpiration. If during the late winter the tree is wounded there will exude from the wound a liquid known as sap, provided that warm days are succeeded by cold nights. This is what the sugar maker calls sap flow. It is due to pressure. Changes in weather such as continued cold or warm or the bursting of the buds stop the sap flow.

Problems of Sap Flow.—The result of the investigation attributed the flow of sap to three causes: (*a*) water content, (*b*) gas content, and (*c*) bleeding of cells.

(*a*) *Water Content.*—Water can enter the tree only through the rootlets, and its only exit is through the leaves, twigs, or wounds. Its function is two-fold, tissue building and transportation. The amount in a tree of given size varies throughout the year. Due to transpiration in the sammer time there is no accumulation and it is generally at its lowest ebb about 26 to 27 per cent. In the autumn the leaves fall, transpiration is reduced to that taking place from the twigs, absorption continues at a somewhat lessened rate and as a result the water content increases so that the water content may be approximately 31 per cent in December and as high as 36 in March. As the snow melts in the spring and warmer weather prevails absorption of water is increased over the winter rate and the water content of the tree continues to increase, reaching a maximum a week or ten days after the close of the sugar season. At this time the water content was 47 per cent. The peculiar things noted are that when the water content was highest there was no sap flow because the buds were beginning to open. Also the sap flow was greatest at the beginning of the season when the water content was at least 10 to 12 per cent below maximum. It must appear from this that the sap flow is not directly dependent upon the amount of water in the tree.

(*b*) *Gas Content.*—As a general rule the tissues of plants contain gases. These consist largely of oxygen, carbon dioxide and nitrogen. These may be absorbed through the roots and leaves or they may be the result of metabolism. It was found that the amount present in the maple tree varied inversely as the water content. At syrup making time it approximated about one-quarter of the volume of the tree. This gas together with the water lies wholly within the cells and conducting vessels, and although the walls of these cells and vessels are readily pervious to water they are much less pervious to the gases. The water content of the cells may vary but the gas content is fairly constant. However, the tension of the gas does not remain constant. It tends to change with alterations of temperature or pressure. A high temperature and low pressure mean greater expansion of the gas, and vice versa. If the gas is confined in fairly impervious walls its volume cannot increase very much. Therefore increase in temperature results in increased pressure. During and just following the season of sap flow the water content of the tree is greatest, consequently the volume of gas must be at a minimum due to increase in pressure from water. As long as the temperature remains fairly constant variations in gas pressure correspond to changes in water content. But during the season of sap flow the temperature does fluctuate and this affects the confined gases. Since there is a limit to their expansion, pressure or suction

results from changes in temperature. High temperatures cause the gases to expand and this increases the pressure; low temperatures cause the gases to contract and suction results. Sap flow and increased pressure are coincident; whatever causes the one results in the other. The immediate cause is the fluctuation of the temperature above and below 32° F. Warm days followed by freezing nights are ideal sap conditions. This appears to produce the alternation of pressure and suction so essential to sap flow. Pressure during the warm day expels the sap near the tap hole and suction during the cold night draws more sap from surrounding tissues into the region surrounding the tap hole.

(c) *Bleeding of Living Cells.*—Bleeding is a function of living cells controlled by their activities. The activity of cells vary from both internal and external causes. It may be daily or seasonal. It is due directly to the action of the protoplasm of the cells. The zero point of bleeding is around 32° F. Bleeding may be thought of as a species of osmosis. Sap flows by osmosis from the cells to the vessels of the wood, causing a pressure. A fall in temperature lessens protoplasm activity and the cells begin to re-absorb the sap. This action produces negative pressure or suction. This seems to be the fundamental cause of sap flow. Water content and gas content are contributory agents only.

HOME MANUFACTURE OF SYRUP

There are many homes where there are a few maple trees in the yard or along the street or road. These should be made to produce at least a part of the family's supply of maple products. The sap is obtained by tapping the trees as described. Any convenient containers found in the home such as lightning jars or tin lard pails may be hung on the spigots to collect the sap. The sap may be evaporated over the kitchen stove or gas range. Shallow vessels rather than deep ones should be used for boiling the sap. These vessels should not be refilled during boiling more than once or twice; rather, the highly concentrated sap should be poured into another vessel and when a sufficient quantity has been secured it should be finished off. It may be boiled to the jelly test or to a temperature of 7° F., above the temperature of boiling water.

The finished syrup is most easily clarified by pouring into a 1-quart or 2-quart fruit jar and allowing it to stand for a day or two. The clean syrup should be poured off the sediment and filled into clean, dry jars. These should be processed in the hot water bath for 4 to 5 minutes.

Syrup of exceptional quality and of very light color may be made

in this way with proper attention to cleanliness and by concentrating the sap in small lots.

If the wood or coal range is used as a source of heat the cost is very low. It requires approximately 200 cubic feet of gas to make one gallon of syrup.

If the doors and windows of the kitchen can be left open during the concentration periods the annoyance of condensed steam on walls and furniture will be reduced to a minimum.

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CHAPTER XXI

CIDER AND CIDER PRODUCTS

Apples vary considerably in their composition, especially in the sugar and acid content. Sweet apples are sweet because of lack of acid whereas acid or sour apples are not deficient in sugar so much as they have a larger acid content. The composition varies not only with varieties but with climate and season. The accompanying table compiled from many sources will give a fairly definite notion regarding the approximate composition of a few of the leading varieties. This list may be extended to cover a much larger number of varieties by consulting the references given.

AVERAGE CHEMICAL COMPOSITION OF APPLES (PER CENT)

	Total Solids	Soluble Solids	Total Sugars	Reducing Sugars	Acid as Malic	Ratio Total Sugars to Acid
Baldwin	18.06	15.50	11.72	7.12	.45	1 : .038
Ben Davis	15.56	12.59	9.86	6.91	.44	1 : .045
Fameuse	15.09	12.45	9.10	7.72	.39	1 : .043
Grimes	17.88	15.18	13.00	8.77	.45	1 : .035
Jonathan	15.19	12.81	9.93	8.28	.42	1 : .042
King	16.48	14.03	10.82	8.43	.38	1 : .035
King David	14.98	12.28	10.60	8.68	.91	1 : .086
McIntosh	15.70	13.28	12.09	9.13	.38	1 : .031
Newtown	16.48	13.73	10.66	7.59	.47	1 : .044
Northern Spy	14.93	11.54	10.22	8.00	.44	1 : .043
Oldenburg	11.70	....	7.92	5.60	.97	1 : .122
Red Astrachan	15.31	12.61	9.20	5.99	1.11	1 : .120
Red Siberian Crab	16.17	12.76	10.25	8.47	.80	1 : .078
Rhode Island	15.76	12.91	10.00	7.80	.51	1 : .057
Roxbury	18.73	15.91	12.28	7.43	.59	1 : .048
Smith Cider	17.37	14.07	9.91	7.54	.51	1 : .051
Stayman	15.83	13.05	11.55	8.11	.52	1 : .045
Wealthy	13.84	11.73	9.11	7.40	.50	1 : .055
Winesap	17.42	14.71	12.22	10.02	.47	1 : .038

Average Composition.—A general average composition for a large number of varieties of apples, from a cider-making viewpoint, is worth the consideration of the careful cider maker. As stated in terms of water and dry matter the average composition of apples is:

A. 1. Dry matter, 14 to 20 per cent
   2. Water, 80 to 86 per cent

Or to carry out the above analysis in more detail, we have the following:

B. 1. Insoluble solids, 3 to 7 per cent
   2. Juice, 93 to 97 per cent
      (*a*) Water, 80 to 86 per cent
      (*b*) Sugar, 9 to 18 per cent
      (*c*) Acid, 0.4 to 1.6 per cent
      (*d*) Extractives, 1.3 to 3.0 per cent

1. *Insoluble Solids.*—These are represented by the skin, seed cases, seeds, the cellulose of the cell walls and the fiber in the core and core lines.

2. *Juice.*—Apple juice consists largely of water with certain solids in solution and with other solids in a more or less emulsified or suspended condition.

Sugar.—The sugars comprise the largest amount of the soluble solids. They consist of approximately one-third sucrose or cane sugar and two-thirds invert sugars of which levulose and glucose are most important.

Acid.—The principal acid is malic and with occasional small amounts of citric acid. Approximately two-thirds of the acid is free. The remainder is in combination.

Extractives.—The extractives include the pectins, tannin, albumin, gums, essential oils, color bodies and soluble minerals.

Yield of Cider.—The amount of juice obtained as cider depends upon a number of factors among which the following are the most important:

1. The variety of apple.
2. The condition of the fruit.
3. The type of equipment.
4. Method of manipulation.

1. *The Variety of Apple.*—Reference to the preceding table will show considerable variation in the amounts of total solids in dif-

ferent varieties. There is also a corresponding difference in the relative amounts of soluble solids in many varieties. In addition to these factors it is well known to the practical cider maker that some varieties of apples " press " better than others, that is, the grated pulp responds more readily to pressure, giving a slight increase in juice flow.

These differences become apparent in both the quality and quantity of juice obtained from different varieties. In extreme cases this difference of yield may amount to 4 to 6 quarts per 100 pounds of fruit.

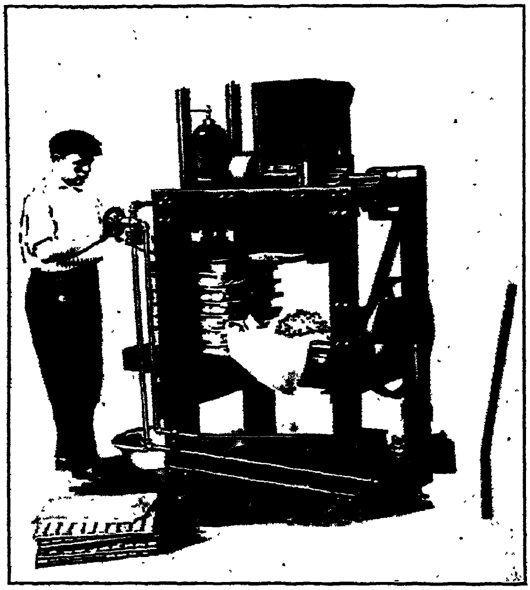
2. *The Condition of the Fruit.*—The largest yield of juice from any given variety of apples is obtained from fruit that is hard-ripe. Hard-ripe fruit may be grated to the proper degree of fineness, which insures maximum yield of juice. There are no large pieces to withhold the juice nor is the pulp so finely divided that it clogs the mesh of the press cloths.

Over-ripe fruit or stale fruit, because of texture, breaks down into a very finely divided pulp during the grating operation. This fine pulp clogs the mesh of the press cloths, retaining a considerable amount of juice, or causes the bursting of the press cloths with the attendant loss of juice.

3. *Type of Equipment.*—The important piece of equipment is the mill or press. A cider mill consists of two essential parts, the pulper and the press. Pulpers are of two kinds: (1) the crusher, usually of cast iron, and (2) the grater, made of steel. The crusher does not make a fine, uniform pulp and this reduces the yield of cider. The acid of the apples acting upon the cast iron often, in fact generally, produces a turbid, dark-colored cider. On the other hand the grater will produce a fine, even pulp and the acids do not affect the steel parts. The yield is greater and the cider is clear and of normal color.

Cider mills are of two general types: (1) the hand mill and (2) the power mill. The hand mill, as a rule, is equipped with a crusher and a screw press. It represents the least efficient type of equipment for the production of cider. The ordinary hand mill, as it is commonly operated, will give a yield of about 2 to 2½ gallons of inferior cider per bushel, which is only a little more than half of the amount present in good hard cider apples. Most hand mills use the hoop type of cheese, in which, the crushed fruit falls into a slatted hoop and when filled half to three-fourths full it is placed under the screw and pressure is applied to this large volume of spongy pulp. Other hand mills use the rack and cloth type of cheese, in which the crushed fruit falls into a shallow frame covered with a stout burlap or special press cloth. When the frame is filled the corners of the cloth are folded over the top surface,

the frame is removed and a slatted rack is placed on top of the folded cloth. The frame and another cloth are placed on this rack and the first operation is repeated until six or more of these thin cheeses, each enclosed in its press cloth and separated from the others by a slatted rack, has been made. This series of small cheeses is then placed under the screw and pressure is applied. This last method of building the cheese will increase the yield of cider almost 50 per cent over the hoop type of cheese. Pressure can be applied much more effectively to these thin cheeses separated by the slats than to a large mass as in the hoop cheese.



Courtesy of the Hydraulic Press Manufacturing Co.

FIG. 48.—A small power cider mill.

The power mill requires some motive power like steam, electric motor, or gas engine. Power mills are universally equipped with a grater and the cheese is of the cloth and rack type. The pressure is generally applied by means of a hydraulic pump. The amount of pressure that may be applied varies according to the size of the mill but is sufficient to give maximum yield. Power mills represent the most efficient type of mill. They give a yield of at least 3½ to 4 gallons of high grade cider per bushel and the labor cost of production is reduced to a minimum. A mill of this type will soon pay for itself in the larger yield of cider when compared with the cheaper hand mills. When cider is to be made in any quantity greater than for home use a power mill should be installed.

4. *Method of Manipulation.*—Proper care in grating the fruit, building the cheese and applying the pressure contributes to increased yields of cider.

The grater should be adjusted to that degree of fineness which will just permit the seeds to pass through without injury to them. Juicy, tender fleshed apples like Fameuse and McIntosh should not be grated as fine as the firmer fleshed varieties. Apples that have been frozen throughout do not require grating as the freezing and thawing have

thoroughly broken up the pulp. This fruit when grated is reduced to such a fine pulp as to seriously impede pressing.

The separate layers of the cheese should be of uniform thickness equal to the depth of the cheese frame. The pulp must be packed snugly into the corners and should be of uniform density throughout. These precautions will prevent tilting of the completed cheese during pressing and will permit uniform pressure throughout the entire cheese.

The pressure should be applied slowly and should be maintained for at least 10 minutes at the maximum pressure. Both the yield and quality are increased if the cheese is allowed to stand for a few hours before pressure is applied. This procedure is not praticable where cider is being made on a large scale. It should be practiced, however, by those who manufacture a small amount of cider each day to supply a retail trade.

The Quality of the Cider.—The quality and value of cider for use as a beverage or for manufacturing purposes depends upon a few well defined factors:

1. Variety of the fruit.
2. Condition of the fruit.
3. Type of equipment.
4. Method of manipulation.

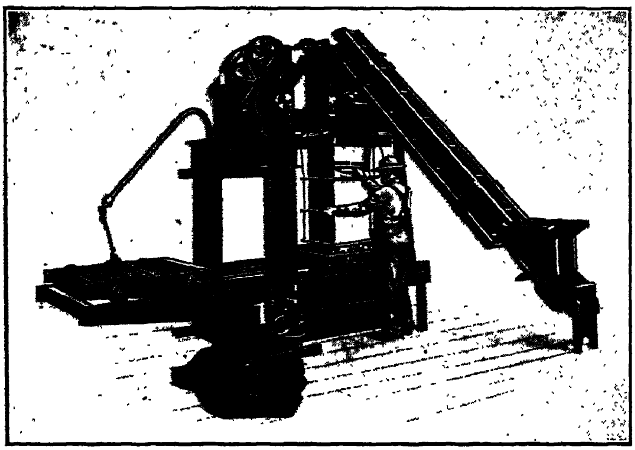
1. *Variety of Fruit.*—As shown in table of chemical composition of apples, varieties of apples differ not only in their sugar and acid content but also in their sugar-acid ratio. These differences will determine the taste of the apple and that of the cider as well. Summer apples as a rule are high in acid and fairly low in sugar. Such apples yield a tart cider lacking in body. Some varieties are aromatic, some have a spicy flavor. These characteristics are transmitted to the cider made from them. There is a wide difference between the spicy flavored, aromatic, heavy bodied cider made from Northern Spy and the acid, thin bodied cider of Oldenburg or the flat cider of Ben Davis. The careful cider maker catering to a beverage trade will learn to blend his aromatic and sub-acid varieties with those of more acid taste in order to produce larger amounts of high quality cider.

2. *Condition of the Fruit.*—Cider can possess quality no better than the fruit from which it is made. Apples that have lain on the ground, especially cultivated ground, for some time have absorbed foreign flavors and are unfit for beverage cider. Apples that contain much rot or scab will produce an off-flavored cider. Over-ripe apples are lacking in quality; and unripe fruit is deficient in sugars, high in acid, and contain sufficient starch to cause turbidity in the cider.

Apples should be hard-ripe, clean and free from excess rot and scab if beverage cider is desired.

3. *Type of Equipment.*—The taste, flavor and appearance of cider are affected by the type of equipment used. Cast-iron graters with hoop type of cheese will as a rule give a cider of mediocre to inferior quality and color. The steel grater and thin rack and cloth cheese give the maximum quality and clearness possible from the fruit being handled. Equipment which returns a maximum yield of cider will, as a general rule, make cider of highest quality.

4. *Method of Manipulation.*—Both the color and quality of the cider are improved if pressing is delayed for some time after grating. The



Courtesy of the Hydraulic Press Manufacturing Co.

FIG. 49.—A large cider mill with hydraulic press.

color of cider is due principally to oxidation changes which occur after grating. A brief interval therefore between grating and pressing allows time for increased amount of color formation. This delay also permits a greater solution of sugars and pectin by the juice, giving more body to the cider.

Too much emphasis cannot be placed on cleanliness of fruit, mill and premises. All equipment and containers which come into contact with the cider should be clean. The mill and press should be thoroughly washed with hot water after each day's operations. All casks, filters, strainers, etc., should be kept scrupulously clean. Nothing will so quickly contaminate cider as unclean equipment and containers. Cider is highly perishable under the best conditions, and when produced under unsanitary conditions its keeping quality is reduced to the minimum.

The Value of the Pomace.—The pulps remaining after pressing are known as pomace. The amount varies considerably but under good working conditions the pomace will be equal to about one-third the weight of apples. This waste material may be converted to a number of uses, among which the following are the most important:

1. Re-pressing.
2. Fertilizer.
3. Stock feed.
4. Jelly stock pectin.
5. Fuel.

FIG. 50.—Inexpensive but efficient equipment for washing apples.
It consists of a deep board trough and a potato or onion shovel.

1. *Re-pressing.*—There are two general methods of handling the pomace when it is to be re-pressed. The first method is to pass the pomace through a pomace picker or regrind through the grater.

COMPARISON OF APPLES AND POMACE

	Percentages of			
	Water	Solids	Sugar	Acid
Apples....................	81	19	12	0.41
Pomace..................	71	29	10	0.36

After picking or regrinding it is rebuilt into cheeses and pressed. The second method is to add water to the pomace until quite moist and let it stand for some hours. It is then re-ground or run through the pomace picker and re-pressed. The cider obtained by this latter method is somewhat dilute and should be used in manufacturing processes such as boiled cider, cider jelly and vinegar.

If cider stock is plentiful it is doubtful if the small cider maker can afford to equip himself for re-pressing the pomace.

2. *Fertilizer.*—Apple pomace, well decomposed, has some fertilizer value. It should be used upon cultivated lands rather than on grass land. Many of the seeds will sprout and grow if the pomace is spread over uncultivated fields.

COMPOSITION OF APPLE POMACE

	Percentages of					
	Water	Ash	Protein	Fiber	Extract Matter	Fat
Pomace	80.8	0.66	0.92	3.09	13.38	1.08
Corn silage	80.0	1.10	1.70	5.40	11.10	0.70

3. *Stock Feed.*—The figures given in the table show that apple pomace is a feed similar to corn silage and of approximately the same value in composition and that pound for pound apple pomace has a feeding value for dairy cows about equal to that of average corn silage. It may be stored in piles under cover or placed in the silo. It may be fed in quantity up to 20 to 30 pounds daily per cow. It is not known to produce any injurious effects on the flavor or taste of milk or butter.

4. *Jelly Stock.*—The bulk of the pectin in the apples is left in the pomace. If the pomace from a lot of apples, not over-ripe, is boiled for 15 to 20 minutes in 3 to 4 times its weight of water the pectin will go into solution and may be recovered by pressing the cooked pomace. The juice obtained is clarified by straining, filtering or sedimentation. The clarified juice is concentrated to about 1 pint per pound of pomace. It may be canned in glass jars or bottled as described for any jelly stock. This liquid is rich in pectin and high in acid. It may be used for jellies and as a constituent of jams and marmalades. Though not as clear and attractive in appearance as pectin solution made from whole apples, it is almost as good except for color and clearness.

Handling the Cider.—Cider as it comes from the press cloths carries some finely divided pomace in suspension. The amount of this suspended materials is determined by the condition of the fruit, the fineness of the grated pulp and the kind and condition of the press cloths. One of the most serious problems of the cider maker is to remove the suspended matter leaving a clear sparkling cider. There are many ways in which cider may be clarified but all of them are not practical for the average cider maker.

(1) *Straining* is the simplest and most efficient method if cider is used for manufacturing purposes or if to be used at once as a beverage. If, however, the strained cider is to be filled into glass jugs and held for some hours a fine sediment, not removed by straining, will form on the bottoms of the containers. This fine sediment is harmless but detracts from the appearance. Cheesecloth or flannel are most commonly used for straining.

FIG. 51.—A barrel arranged for straining cider. An outer cloth of coarse weave and an inner one of fine weave remove practically all suspended pulp.

(2) *Sedimentation* gives a clear sparkling cider, but the length of time required to complete the clarification process is often objectionable. Sedimentation is carried out in the following manner. The strained cider is filled into casks or tanks and allowed to stand for several hours. The fine sediment settles to the bottom of the container and the clear cider is drawn off, leaving the sediment undisturbed.

(3) *Filtering.*—There are many types of filters offered by dealers in cider-making supplies. And some good type of filter would be most practical for those handling cider on a large scale. The small cider maker will find much satisfaction in the use of one or two felt filter bags such as are used by maple syrup makers to remove the "sugar sand" from their syrup. The strained cider is passed through one or even two of these heavy felt bags giving a very satisfactory cider. These filter bags are easily cleaned and may be kept sweet and free from all contaminants, which is more than can be said of some types of more elaborate and expensive filters.

Testing the Cider.—The value of a cider for manufacturing purposes depends largely upon its sugar content. Its value as a beverage is determined by both its acid and sugar content and by its flavor and clearness. Cider may be tested for sugar by means of a Brix or Balling saccharometer. Since there are solids other than sugars present in the cider it is customary to subtract $1\frac{1}{2}$ from the reading given by the saccharometer. The acid may be determined by the usual method of titration.

FIG. 52.—Equipment for straining cider and other fruit juices.

USES FOR CIDER

1. Cider as a Beverage.—Just what the fruit grower will do with his cider will be determined by his own particular conditions. Many eastern growers find the sale of sweet cider to the roadside stand trade the most profitable means of disposing of their culls and cheap grades, while a few market the bulk of their crop in this manner. The great trunk highways over which thousands of automobiles pass daily offer exceptional opportunities for the producer to come into direct contact with the consumer. By using proper methods in manufacturing and by use of ice or cold storage to keep the cider sweet it may be sold many hours after manufacture without danger of violating the provisions of the Prohibition law.

Thorough cleanliness of equipment, premises and all containers will aid very materially in the keeping quality of the cider. Cider stored at a temperature near the freezing point may be held for several weeks without fermenting.

Benzoate of Soda as a Preservative.—The use of benzoate of soda as a preservative of sweet cider is permitted by the Pure Foods Regulations provided its presence is declared on the label of the package. The

regulations suggest (7 to 8 ounces per 50 gallons—approximately 0.1 per cent) as a maximum amount. But many manufacturers exceed this and as a result their cider has an unnatural color and a foreign flavor and taste. One of the most common methods of spoiling good cider is by adding an excess of benzoate of soda. Careful handlers of sweet cider have found by experience that when the benzoate of soda is reduced to 0.075 per cent (about 5 to 6 ounces per 50 gallons) results are much more satisfactory. The cider keeps practically as well as when a larger amount is added and there is no perceptible change in color or quality. Only the most highly refined preservative should be be used.

Pasteurized Cider.—Pasteurized cider has not become as popular as many believed it would. This is largely due to the fact that as yet

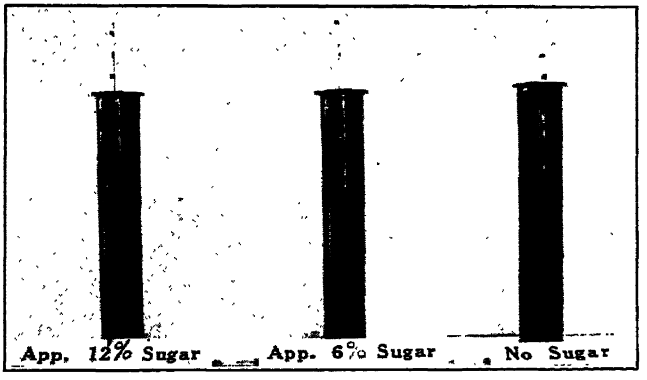


FIG. 53.—The saccharometer may be used to show the approximate sugar content of sweet cider or fermented cider.

no one has produced a pasteurized cider that possesses the quality of fresh cider. When cider is heated to a pasteurizing temperature it acquires a foreign flavor, which is objectionable. This may be minimized by special treatment of cider before bottling or by thorough aeration just before drinking. But with the best means at hand at the present time pasteurized cider as a beverage is not popular with those who know and appreciate good fresh cider.

The preservation of cider for home use by pasteurization is essentially as follows: The fresh cider is filled into clean, glass jars. The jars are partially sealed and are pasteurized in the water bath at 165° F., pints 20 minutes, quarts 30 minutes. After standing a few days the precipitated and suspended materials will settle to the bottom forming a layer of sludge. If the cider is to be clean and free from sediment, the jars are opened and the clear cider poured off, leaving the sludge

undisturbed. This clarified cider is filled into clean containers partially sealed and pasteurized at 160° F. for the same periods as given above. Cider so treated will have a slight cooked flavor. Thorough aeration by pouring back and forth from one vessel to another a number of times and chilling to near the melting point of ice will minimize the foreign flavor.

MANUFACTURED PRODUCTS

Boiled Cider

This is a standard product throughout many sections of the country. When properly made it has an attractive reddish color and possesses

Fig. 54.—"*Waste*" apple of these grades should not be sold as fresh fruit except for manufacturing purposes.

high quality. Its principal uses are in mincemeat and as a base for fruit drinks. The cider from which boiled cider is made should be sweet and of fair to good quality. It is manufactured in a small way by concentrating a few quarts at a time to approximately one-fifth of the original volume. The concentration is by rapid boiling in aluminium or enameled vessels. When made on a large scale the regular continuous type of fruit juice evaporator is used. These evaporators may be purchased from dealers in cider equipment.

When the boiled cider reaches the desired degree of concentration it is strained and allowed to clarify further by sedimentation. After standing for 24 hours the clear liquid is drawn off and filled into clean containers. Preservation is effected by pasteurizing the filled containers at 170° to 180° F. for 15 to 20 minutes for pint jars.

Cider Jelly

Cider jelly is of a dark reddish brown color. It has a very acid taste but the flavor is excellent. It should be tender and easily spread. If cooked too long it becomes firm and tough. It is an excellent relish and is often used in making jelly rolls.

Cider jelly is made by boiling fresh sweet cider to the jelly test, or to 7° to 8° F. above the temperature of boiling water. The finished jelly is strained through a single layer of good cheesecloth and poured into clean, dry glasses. When the jelly has set, paraffin is added, the covers are adjusted and the jelly is stored. When made on a large scale the continuous evaporator is used. A better quality jelly is pro-

Fig. 55.—"Thrift"—A variety of products which may be made from cull apples.

duced by use of the evaporator than can be made by kettle boiling. In making jelly by ordinary home methods best quality will be had if the cider is handled in small batches. Long cooking will darken the color and the jelly will have a caramel flavor.

Cider that has been pressed from frozen apples is rich in pectin. Such cider may be sweetened by adding 2 to 3 pounds of sugar per gallon. The added sugar improves the color and the jelly is less acid.

Cider Syrup

Cider syrup has little if any commercial value at present. It may be found useful in the home and is of interest to the laboratory worker.

It is a deep reddish brown syrup having a flavor very similar to that of baked apple juice. In addition, however, the tannin present causes a slight astringent effect upon the membranes of mouth and throat.

Its manufacture is essentially as follows: Fresh sweet cider is heated to boiling point and powdered chalk (Calcium Carbonate) is added a little at a time at the rate of $\frac{3}{4}$ ounce per gallon. After all the carbonate is in and rapid evolution of gas ceases, the hot material is set aside to clarify by sedimentation. After standing several hours there will be a heavy deposit in the bottom of the vessel. This precipitate is made up of the coagulated suspended matter, the insoluble calcium malate formed by the acid reacting with the calcium carbonate and any excess of the carbonate added. If allowed to stand for several hours the liquid generally turns black but regains its natural color on heating.

The clear liquid is drained from the sediment and concentrated by rapid boiling to about one-sixth of the volume of clear liquor. This concentrate should stand for a few days to permit a second clarification by sedimentation. When clarified, the syrup is poured off, bottled and processed in water bath for 2 to 3 minutes.

Over-concentration will cause a deposit of sugar in the bottom of the containers. The syrup may be used as a table syrup or as a dressing for breakfast cereals.

Apple Butter

This is one of the best of the apple products and should be eaten in large quantities. If it is to be manufactured in even a semi-commercial way the following equipment is necessary. A cider mill, a steam jacket kettle or preferably a fruit-butter cooker, a small boiler for steam and a cradle type colander or a cyclone pulper. All of this equipment may be purchased from dealers in cider making equipment.

Method of Manufacture.—The small well-colored, defective apples should be used for butter stock. The fruit is washed, and all decay, scab and insect injured spots are removed. The fruit is halved and the blossom is cut out. The prepared fruit is weighed or measured and placed in the cooker and for each bushel of prepared butter stock 6 gallons of good quality sweet cider are added. The steam is turned on, the cooker covered, and the fruit is boiled until reduced to a fine pulp. The steam is turned off and the contents of cooker are allowed to cool 10 to 15 minutes, after which the steam coil is lifted and the cooker is moved to one side. If the coil is lowered into a tub containing enough water to cover it and steam is turned on to heat the water almost to boiling there will be little trouble in cleaning the coil. The cooked fruit is run through the colander or pulper. This operation reduces the pulp to a fine even grain and removes seeds, seed cases, skin and stems. The cooker should be rinsed out to remove all traces of fruit. The coil is brushed clean and returned to the clean cooker. The pulp

is added and steam is turned on. The pulps are boiled rapidly until the hot material will round up somewhat on a spoon.

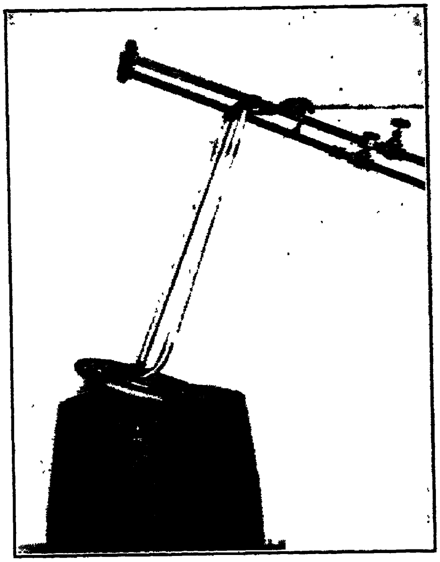


FIG. 56.—Apple butter cooker.

The amount of sugar to be added depends upon the acidity of the fruit and the use for which the butter is intended. If for a relish the ratio is small, 2 or 3 pounds per bushel of butter stock, but if to be used as a spread the ratio should be 4 to 6 pounds. The sugar should be made into a syrup by adding one cup of water per pound of sugar and heating until the sugar is in solution. The amount and kind of spices is a matter of taste. Spices should not obscure the flavor of the fruit. Two ounces of ground cinnamon and 1 ounce of ground cloves per bushel of fruit will give a mildly spiced butter. The spices should be added as a thin paste. This is done by adding water a little at a time

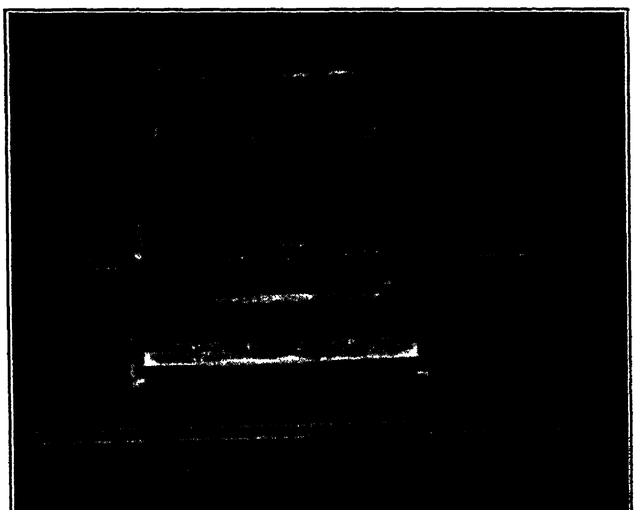


FIG. 57.—A cradle type colander for use in handling large quantities of materials.

to the spices, stirring to prevent the formation of small lumps. When

perfectly smooth and thin enough to pour readily the syrup and spices are added to the butter. Cooking is continued until the hot pulps sheet from the spoon or if a small amount is placed on a plate no free liquid separates from the solids. Good apple butter should be too thick to pour but not thick enough to be gummy or to set like a jelly.

When finished the hot butter is filled into clean, dry containers which are partially sealed and processed in the water bath for 2 or 3 minutes. For further discussion of fruit butters in general see the Chapter on Fruit Butters.

VINEGAR

Definition. "Vinegar is a weak solution of acetic acid in an aqueous fluid prepared by the oxidation of alcohol by means of acetic acid bacteria."

The manufacture of vinegar from sweet cider involves a double fermentation; that is, there are two distinct fermentation processes or chemical reactions; one closely following the other. The chemical changes which take place during the stages of fermentation may be illustrated by the following reactions:

1. Alcoholic fermentation:

$$\underset{\text{Sugars}}{C_6H_{12}O_6} + \text{yeast action} = \underset{\text{Alcohol}}{2C_2H_6O} + \underset{\text{Carbon Dioxide}}{2CO_2}$$

$$72 + 12 + 96 = 48 + 12 + 32.$$

$$180 \text{ parts} = 92 \text{ parts.}$$

$$1 \text{ part} = 0.51 \text{ part.}$$

The sugars of the sweet cider are broken down by the yeasts to form alcohol, which remains in solution and carbon dioxide which bubbles off as a gas. The chemical reaction above shows that approximately 2 parts of sugar are required to produce 1 part alcohol. This cider, which after fermentation contains alcohol, is known as hard cider.

2. Acetic fermentation:

$$\underset{\text{Alcohol}}{C_2H_6O} + \underset{\text{Oxygen}}{O_2} = \underset{\text{Acetic Acid}}{C_2H_4O_2} \quad \underset{\text{Water}}{H_2O}$$

$$24 + 6 + 16 = 24 + 4 + 32$$

$$46 \text{ parts} = 60 \text{ parts.}$$

$$1 \text{ part} = 1.3 \text{ parts.}$$

The alcohol in the hard cider is oxidized by the action of acetic bacteria to form acetic acid and water, both of which remain in solution.

The equation shows that 1 part of alcohol will produce about 1.3 parts acetic acid.

Theoretically then a sweet cider carrying 10 per cent of sugar should ferment into a 5 per cent alcoholic hard cider which in turn should give a vinegar of 6.5 per cent acetic acid. In general practice, however, such a sweet cider would yield a vinegar of approximately 5 to 6 per cent acetic acid.

The chemical changes illustrated above are brought about through the action of bodies known as ferments. These ferments are microscopic plants of low order and are known respectively as yeasts and bacteria. Like all plants these ferments require certain conditions under which they grow best and thereby perform most effectively the work desired. If the proper conditions prevail the results are reasonably certain, and good vinegar results. If conditions are not right, results are most likely to be discouraging. It is in this matter of supplying the necessary conditions for most effective work of the yeasts and bacteria that the amateur manufacturer makes his greatest number of failures.

A brief discussion of yeasts and bacteria at this point will serve to emphasize and explain certain statements to be made later.

Yeasts.—The yeasts belong to the low order of plants known as budding fungi. They have an almost universal distribution due to their minute size and to their ability to retain their vitality for a considerable time in a dried condition. These light, dried yeast plants, or their spores, are blown freely about and this fact explains why any sugary solution left exposed for a few days undergoes fermentation. Dry yeasts are harmless, but as soon as given the necessary conditions they assume active growth and they then become potent factors for either good or evil. The yeasts that are found so generally distributed everywhere are known as wild yeasts in order to distinguish them from the ones we cultivate and grow in large numbers for bread making, brewing, etc.

Yeasts differ greatly in their ability to ferment. Some are slow acting, some are very rapid. Some give offensive odors or undesirable flavors or colors. Some will cause a complete fermentation of the medium in which they are growing; that is, all the available sugars will be changed. It will be seen from the foregoing how very desirable it is to have present the proper kind of yeast when fermentation is to be carried on.

The activity of the cultivated yeasts is greatest when in a dilute sugary solution and when the temperature is around 70° to 90° F. As the temperature falls much below 70° F. their active growth decreases

until it ceases at a few degrees above the freezing point. Practically all yeasts become inactive when the medium in which they are growing becomes too acid. Very few will continue to be active in cider when the acetic acid strength reaches 1 per cent and even less than this will retard growth. This explains why in making vinegar the alcoholic fermentation should be completed before the acetic fermentation is allowed to begin.

Yeasts do not confine their activities to the surface of the mass of cider but are more or less distributed throughout, being especially numerous at or near the bottom. No provision for the admission of air to the fermenting cider is necessary, but some provision must be made for the escape of the carbon dioxide.

Acetic Bacteria.—The acetic bacteria are like the yeasts in that they belong to a low order of plants, and have a very wide distribution and when given suitable conditions they grow and multiply at a very rapid rate. The conditions necessary for their rapid growth are a weak alcoholic solution, abundance of air and a temperature of 70° to 90° F. During their growth they break up the alcohol, which recombining with oxygen of the air produces acetic acid and water. The most rapid conversion of alcohol into acetic acid occurs when the medium in which they are active carries 6 to 8 per cent of alcohol and this condition will be met in a good grade of hard cider. Since this change is an oxidation process a supply of air must be available. This condition is met by carrying on this stage in containers that are open sufficiently to supply the necessary oxygen in the air.

Unlike the yeasts the acetic bacteria are found only on the surface of the fermenting liquid, and they must be supplied with abundance of air. At first only a thin greyish veil-like membrane is formed over the exposed surface and it gradually thickens by the addition of both living and dead bacteria and the precipitated and coagulated materials from the cider. The color also changes, assuming a brownish, leathery hue. Any disturbance of the liquid at this time, or often its own weight, will cause this mass of living and dead bacteria to sink to the bottom, where being deprived of air the living organisms become inactive. This slimy, leathery mass is popularly known as "mother" of vinegar and is recommended by many to be used to inoculate fresh barrels of hard cider. This should be regarded as a hazardous undertaking. Such "mother" should never be used.

Farm Method of Manufacturing.—*Alcoholic Fermentation.*—Cider fresh from the mill should be placed in clean, sterilized kegs or barrels, filling them practically full. The casks should be laid on the side in a room where the temperature can be kept somewhere near 75° to 85° F.

Temperatures much below this will retard the fermentation and higher temperatures will cause some loss of alcohol through evaporation.

In order to control the type of fermentation a culture should be added. This may be prepared as follows: For each barrel to be fermented two or three cakes of baker's yeast are dissolved in a small quantity of warm water. If this can be prepared a day in advance either sweet cider or the juice obtained by cooking some apples in an excess quantity of water, is substituted for the water. If placed in a warm room the yeasts in the culture will be very active within two or three days. Subsequent casks may be properly inoculated by adding one or two gallons of cider taken from rapidly fermenting casks.

As stated above, the barrel is laid on its side, with the plug removed, and the culture is poured in and mixed thoroughly. The opening into the cask should then be closed by a ventilating funnel, or loosely plugged with cotton in order to exclude dirt and insects. A cheap fermenting funnel may be constructed as follows: A short length of small rubber hose is fitted into a hole of suitable size bored in the bung. The hose may be sealed in air-tight by pouring hot paraffin around the point of union. This should not be done, however, until the bung has been tightly driven in. The free end of the hose dips below the surface of water in a glass fruit jar or tin can. The carbon dioxide can readily escape through the tube.

If conditions are right rapid fermentation will begin in a few days and will continue uninterrupted until its completion. This will require from 2 to 6 weeks. When conditions are ideal 3 to 4 weeks have been found to be sufficient for full barrels. However, best results will be obtained if at least 6 weeks are allowed for this stage. If the necessary equipment is at hand, and it can be secured for a small sum, tests may be made after the lapse of a few weeks either for the percentage of alcohol or for the amount of sugar. For the former a small distilling apparatus is required, while a hydrometer may be used for the latter. When the hydrometer reading of the fermenting cider is approximately zero the sugar has all been converted into alcohol. Many fruit growers use a Baumé hydrometer to determine the strength of spray solutions. This will do for determining when the alcoholic fermentation has been completed. A Brix hydrometer reading 0° to 30° or a Balling hydrometer will give the approximate sugar content of cider at any stage of its fermentation. If a fermenting funnel were used it will show when fermentation is practically completed, as gas no longer bubbles off from the barrel.

When the alcoholic fermentation has been completed the hard

cider should be transferred to a clean cask. The cider is allowed to flow through the spigot until sediment begins to show. The remainder is strained through several thicknesses of cheesecloth. The casks in which the next step—acetic fermentation—is to be carried on should be filled only about three-fourths full; since acetic bacteria require a constant supply of air, provision must be made to meet this requirement. If holes 1 inch in diameter are bored in each end of the cask just above the level of the cider the supply of air will be increased and as a result the bacterial action will be more rapid.

Acetic Fermentation.—This stage of the process should be under control as was the preceding one. The temperature should remain approximately the same. The culture should be started a day or two in advance. To make this culture equal parts of the hard cider and well-flavored vinegar, about a pint or quart of each, are mixed in an enamel or wooden vessel, the vessel is covered with cheesecloth and set in a warm room. In a day or two a thin whitish, gelatinous substance will be found forming over the exposed surface. This is the true "mother" of vinegar, that is, it is a mass of active acetic bacteria. When this covers the surface a light splinter may be used to remove as much of it as possible and drop into the cask of hard cider. The splinter being light will float and keep the acetic bacteria on it where they can obtain the needed supply of air.

As in the case of the alcoholic fermentation the cask should lie on its side with the plug out. The opening should be loosely stopped with cotton or else covered with cheesecloth. The openings through the ends of the barrel near the surface of the cider should also be covered. It might be well to repeat the precaution already given that during acetic fermentation the cask should not be moved nor disturbed unless absolutely necessary.

If conditions are favorable the acetic fermentation will be completed in 2 to 4 months. If one has the necessary equipment tests may be made to determine the amount of acetic acid present. Very simple and efficient equipment may be purchased from dealers in vinegar or cider supplies, or the State Experiment Station may be called upon to make the necessary tests. The manufacturer who expects to sell vinegar should consult the laws of his state regarding the state requirements.

When vinegar tests around 5 per cent acetic acid or above, the clear vinegar should be drawn from the casks and filled into clean, tight casks, closely stoppered or bunged, and then placed in a cool place for 6 to 12 months to ripen.

Freshly made cider vinegar is deficient in quality and color. During

the ripening period it develops the aroma, rich color, and high flavor for which it is prized.

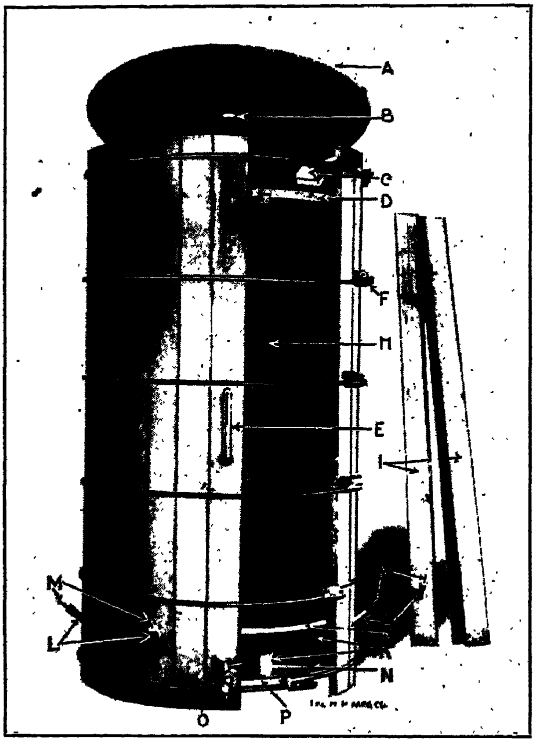
The fruit grower who manufactures vinegar for sale will find a local market. He is therefore interested only in the state laws regulating the standard for vinegar. The federal standard applies only to interstate traffic. The state department of agriculture will be able to supply the necessary information regarding testing, standards and laws relating to manufacture and sale.

Commercial Methods.—The manufacture of vinegar on a large commercial scale could not be successfully managed by the cask method of fermentation just described. The small manufacturer may make use of the rolling generator but the larger operators rely entirely upon the upright generator.

The Rolling Generator Process.—The rolling generator is essentially a cask-shaped vessel a little larger than a barrel. It is divided lengthwise into two compartments by means of a slatted partition. The compartments are unequal in size, the smaller comprising about one-third of the cask. This compartment is filled with beechwood or rattan shavings or broken corncobs. There are three openings into the cask, one corresponding to the bung directly over the center of the smaller compartment and one at each end just beneath the partition. The generator is operated as follows: Cider, which has passed through the first stage of fermentation, is mixed with some good starter, like vinegar mother. Several gallons of this are placed in the generator. The openings at ends and the bung are closed and the generator is rolled or turned until the small compartment is at the bottom. When shavings are thoroughly saturated, after a minute or two in this position, it is rolled back bringing this compartment to the top. The plugs are removed to allow air to enter. This is repeated several times each day for 2 or 3 days. By this time the shavings are thoroughly coated with the vinegar mother and the generator is ready to operate. The starter is drawn off and the lower compartment is filled with hard cider up to the openings in the ends. Two or three times each day the openings are closed and the generator is rolled to submerge the generating compartment for a few minutes and is then rolled back to the normal position; the plugs are withdrawn and fermentation goes on rapidly. Under proper temperature conditions the vinegar will be finished in a week to 10 days. The vinegar is drawn off and the generator recharged with hard cider and the operation continued as before.

The Upright Generator.—This is also known by the name of rapid generator. It is a large cylindrical-shaped vessel divided into three

compartments. The receiving compartment is at the top; it is only a few inches in depth and its floor is known as the perforated head. Just below this is the generator proper, which occupies most of the vessel. At the bottom is a shallow compartment known as the collecting tank. Around the upper part of this compartment are several holes sloping upward fitted with adjustable plugs. These are the ventilators. Resting on the perforated head is the distributer, which may be a tilting trough so constructed that it automatically empties itself on becoming filled to proper depth or the distributer may be a sparger so constructed that it will spray continuously a quantity of hard cider uniformly over the perforated head. The generating compartment is packed with beech wood or rattan shavings.



Courtesy of Hydraulic Press Mfg. Co.

FIG. 58.—Detail of a rapid vinegar generator.

A. The cover. *B*. Ventilator. *C*. The Distributor. *D*. Perforated head. *E*. Thermometer. *F*. Round hoop. *H*. Generating compartment to be filled with shavings. *I*. Staves removed to show construction. *J*. False bottom. *K*. False bottom supports. *L*. Slugs to regulate air supply. *M*. Pins in plugs for close regulation. *N*. Collecting compartment. *O*. Spigot. *P*. Tight bottom.

Hard cider treated with fresh vinegar mother is run through the generator for a few hours until the shavings are thoroughly covered with vinegar mother. This liquor is then drawn off, and hard cider is run in. If everything is working well and if the generator is of sufficient size the liquid that collects in the tank at the bottom will be vinegar. A generator 4 feet across and 12 to 14 feet high will manufacture 60 to 80 gallons of vinegar per day. This is possible (1) because of the enormous fermenting surface afforded by the shavings, (2) the rapid inflow of air through the ventilators and (3) because the delivery of hard cider may be adjusted to the proper amount.

Vinegar manufactured by the rapid generator process should undergo

the same ripening process as that made by the cask fermentation method.

Problems in Vinegar Manufacture.—The small vinegar manufacturer discovers many problems connected with the business of changing sweet cider into good marketable vinegar. Some of these problems are easy of solution and in fact may be avoided; others tax the ingenuity of the most expert to arrive at a satisfactory solution.

Vinegar Eel.—The vinegar eel is one of the family of nematodes. It is cylindrical, tapering to a point at the posterior end. It is approximately $\frac{1}{16}$ inch in length. It is capable of thriving in either weak alcohol or dilute vinegar but is killed at a temperature around 150° F. These minute animalcules breathe air and must therefore come to the surface of the liquid to obtain air. This habit results in a continual struggle between the acetic bacteria and the eels for air supply. If the eels gain the supremacy they prevent the proper formation of vinegar mother and consequently fermentation falls to a low ebb. If, however, the acetic bacteria succeed in forming their characteristic membrane over the free surface of the fermenting vinegar the eels cannot break through to secure their air supply consequently they settle to the bottom of the vinegar and perish.

Just how this pest gets into the vinegar has not yet been satisfactorily determined. It has been suggested that they are soil types of organisms and would be found on apples that had lain on the ground. Others suggest that the water used for washing is most likely the source. Still others believe that the ova are transferred by the air. They do not, however, know from whence they have been transferred. In whatever manner they happen to get into the vinegar room they are a serious pest.

The living and dead eels may be removed from the fermenting vinegar by filtering. Some, perhaps many, of the ova, however, pass through the filter bag and eventually a second crop of eels will be found in the fermenting vinegar. They may be very effectively removed from finished vinegar by heating it to 160° F. for a few minutes. Both adults and ova are killed. The filter bag will remove all dead eels, leaving a pure wholesome vinegar.

No harm results from using vinegar containing eels. The thought of using such vinegar is, to say the least, not very appetizing.

The following suggestions will be helpful in controlling this pest. (1) All fruit should be thoroughly washed. (2) The casks or tanks in which cider is handled or stored should be thoroughly steamed or they should be rinsed and sulphur should be burned in them. The containers in which cider and vinegar are stored or in which they are fer-

menting should have all their openings screened or loosely plugged with cotton.

Vinegar eels are large enough to be seen and where present they may be detected by drawing some of the vinegar into a narrow glass tube. The eels may be seen as they travel up and down through the column of vinegar or as they gather at the surface of the vinegar column. Or if a small amount of the vinegar is poured into a shallow dish they may be seen around the outer edge of the vinegar.

Vinegar Flies.—The vinegar fly is a small insect commonly found wherever fermentation is being carried on or where there is some decayed fruit. They are most numerous during the hot summer months. Just how much if any injury they do is not definitely known. It has been suggested that they may be responsible for the spread of vinegar eels from one cask to another. This seems possible if casks are left open.

Cleanliness of premises with an occasional spraying with some of of the fly destroying liquids now on the market will effectively control this pest.

Turbidity.—Turbid vinegar may be the result of starch in the fruit or of some foreign action during fermentation. Such vinegar has a low market value. Its appearance may be improved by fining. Bioletti gives the following instructions regarding fining. " Each hundred gallons will require $\frac{1}{2}$ to $\frac{3}{4}$ ounce of isinglass. The isinglass is cut into narrow strips and soaked in a small amount of water, to which has been added tartaric or acetic acid equal in weight to the isinglass. When it is thoroughly soft it is rubbed through a fine sieve or pressed through a linen cloth. Water is added to form a perfect liquid. This fluid is then poured into the cider and thoroughly mixed with it. When the finings have settled to the bottom of the cask the vinegar may be drawn off into a clean cask or it may be bottled.

Failure in Fermentation.—Many of the attempts to make cider vinegar in the home result in failure. Some of these failures, perhaps most of them, are due to interruption in the fermentation process. A cask of sweet cider placed in a cold room or in a cold cellar late in the autumn may undergo a part of the yeast fermentation. Due to low temperature the yeasts finally become inactive and lie dormant throughout the winter. When spring comes and the cider becomes warmed somewhat, either the yeasts will resume activity or the acetic bacteria will become active. If the latter should become active first the acidity of the cider is increased and will soon reach a degree that will effectively stop all yeast action. When the alcohol has been converted into acetic acid the bacteria are without food and consequently they perish or become dormant. The result is a cask of " sour cider " which tests

1 to 3 per cent acid and has 4 to 8 per cent sugar. This cannot be made into good vinegar.

Too much emphasis cannot be placed on the necessity of keeping the cider at a temperature at least above 60° F. during both the yeast and acetic fermentation.

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CHAPTER XXII

MEATS AND MEAT PRODUCTS

Hogs may be raised and the meat cured on the farm at much less cost than the purchase price of such meat. Where proper care is given to the curing of bacon and hams the quality of home-cured is superior to the general run of factory-cured. In addition to the meat there are the by-products, lard, sausage, etc. All of these may be of superior quality.

But even with these advantages the home curing of meat is decreasing and in many communities has become one of the lost arts. This condition is explained by some as the result of slipshod methods resulting in poor quality products and to the general tendency to specialization.

Preserving Fresh Meat.—Fresh meat may be preserved in the home by two methods: (*a*) by low temperature and (*b*) by partial cooking.

(*a*) *Low Temperature.*—During cold weather when the temperature is as low as 36° F. without any considerable fluctuation above that, meat may be kept for several weeks. Or should the temperature fall below freezing the meat will keep as long as it remains frozen. This period may be somewhat prolonged by packing frozen meat in snow and keeping in a cool place.

(*b*) *Partial Cooking.*—This method will keep meat fresh until late summer. It may be applied to both pork steaks and sausage. The pork to be kept is cut into slices and fried enough to sear well on both sides, and is then packed into earthenware jars or crocks. The sausage is made into " pats " and treated in the same way. When the container is almost full fresh lard is melted and poured in to cover the meat, effectually sealing it. When meat or sausage are being used from the jar, that left in the jar should be kept covered by melting and pouring back the lard removed.

Curing Pork.—Two methods are in common use for curing pork. They are known as: (*a*) Dry cure and (*b*) Brine cure. Advantages are claimed for each of these methods and in those sections where the temperatures run at least as low as freezing during winter, either method will give satisfactory results, but in the warmer sections the brine cure is not recommended. It is slower than the dry cure and if the tem-

perature is high spoilage may set in before the brine cure becomes effective as a means of preservation.

All body heat should be out of the meat before applying either cure. A good plan is to allow the dressed carcass to hang for 12 to 15 hours before cutting. The pieces are then rubbed lightly with fine salt and allowed to lie spread out on the table overnight.

(*a*) *Dry Cure.*—The materials required per 100 pounds of meat are: 6 to 8 pounds of salt, 2 to 2½ ounces of saltpeter, 2 to 3 pounds sugar. The saltpeter is finely pulverized and all three materials are thoroughly mixed and divided into three equal parts.

The meat which has stood overnight after being lightly salted is placed on the table. One portion of the cure is applied by rubbing some of it on the fleshy side of the pieces, especial care being taken to pack the shank of the shoulders and hams and to leave a little extra on the bone where it comes to the surface. The meat is packed into the barrel or box, skin side down. When the first layer is completed, the cure is lightly sprinkled over the surface. Another layer of treated meat is packed on the first in same manner as given for bottom layer; and so on until all the meat is packed. The container is covered to exclude rodents. After 5 or 6 days the meat is all lifted and repacked, using the second portion of the cure. Again after 5 or 6 days the meat is lifted and repacked, using the last third of the cure. It is allowed to remain until the process is completed. This is determined by the size of the pieces. Approximately 2 days for each pound weight of the pieces, that is, a 10-pound ham will require approximately 20 days from the last application of the cure. When the cure is completed the meat is removed, the excess cure brushed off, the pieces are washed in warm water and hung to drip a few days before smoking.

(*b*) *Brine Cure.*—The brine cure is prepared by dissolving 8 to 10 pounds salt, 2 to 3 pounds of sugar and 2 to 3 ounces of saltpeter in 4½ to 5 gallons hot water. The meat which has stood overnight after being rubbed lightly with fine salt is packed skin side down into a water-tight container of suitable size and the cold brine cure is added. A board with weight should be used to keep the meat submerged. The meat should be kept in a reasonably cool place. After standing 5 to 6 days the meat is taken out and packed. After standing 5 to 6 days the meat is again taken out and repacked, the same brine being used. After an interval of 5 to 6 days it is again overhauled and repacked. It is now left in the brine until curing is completed. This will require approximately 3 days for each pound weight of bacon and 4 days for each pound weight of ham or shoulder. For example, a 10-pound piece of bacon would require 30 days, whereas a 10-pound ham

should be left in the cure for 40 days. When the curing is completed the pieces are removed, rinsed in warm water and hung to drip preparatory to smoking. Or if a moderate temperature can be maintained the meat may be left in the cure until used. If the brine should become ropy during the curing process it should be discarded, the meat rinsed clean and covered with fresh brine.

Smoking.—Smoking aids in the preservation of the meat and also gives it an agreeable flavor. The heat developed during smoking also serves to dry out the meat.

The smoke house should be of size to accommodate the amount of meat to be cured. If of a permanent character it should be of stone, concrete or brick. If only a small amount of meat is to be smoked a large box or even a barrel may be used. The meat is hung in the box and the smoke is conducted into it from a fire pit or stove outside. This same system may be used to convey smoke into the smoke house. The common method, however, is to have a slow, smoldering fire in a large iron kettle placed beneath the meat. The fuel should be hickory, maple or other hard wood. Corn cobs may be used. Resinous woods will flavor the meat and are unfit for this purpose. Soft woods burn too rapidly and give off too much heat.

The pieces of meat should not touch as they hang in the smoke house. This will allow free circulation of the smoke and an even browning of the meat. As a rule the smoking is not all given at one time unless the temperature is low enough to freeze the meat. Smoke is applied for 6 to 8 hours each day or for 2 or 3 days and after a day's interval it is again applied for 2 or 3 days. Generally two periods will be sufficient. If given all in one period 4 to 5 days' smoking will give good color and flavor.

After smoking, the meat must be protected from flies and rodents. The smoked meat is rolled in several layers of papers and enclosed in a cloth covering or bag, which may be packed in a tight box or barrel or hung from the ceiling or rafters out of reach of rodents.

Liquid smoke, which is a harmless solution of creosote and other constituents of smoke, is used largely by commercial manufacturers. The farmer may use this if facilities for smoking are not available. It will not give as good flavor but it will function satisfactorily as a preservative.

Rendering Lard.—Three grades of lard are found in the hog carcass. The leaf lard from the layer of fat within the abdominal cavity is the best; that from the back, sides and trimmings is second; and the poorest comes from the intestinal fat. The first two are usually mixed together, but the third should be rendered by itself and should not be

mixed with other lard. The intestinal fat should soak in water for several hours before rendering.

Preparation.—The leaf lard is cut into 1- to 1½-inch cubes, the fat from sides and trimmings should have all lean meat removed and the fat should be cut from the skin. This fat is cut into small cubes (1- to 1½-inch).

Heating.—The prepared fat is placed in the kettle and a small amount of water, 1 cup to 1 quart depending on amount of fat, is added. Gentle heat is applied with frequent stirring until the fat begins to liquefy. At no time should excessive heat be used. When the cracklings—the part of the fat not liquefied—turn brown and float on the surface the lard is sufficiently cooked. The cracklings may be skimmed off and pressed to extract all the lard, or the lard may be strained through a cheesecloth. The addition of 1 ounce of baking soda per 100 pounds of lard after removal from fire and frequent stirring while cooling will make the lard white and smooth.

Storing.—Before cooling too much the lard is poured into vessels for storage. The glazed earthenware jars or sealed glass jars may be used. If sealed in glass jars, lard will keep indefinitely. Earthenware jars should be carefully covered and stored in a cool place.

PORK PRODUCTS

Sausage

Pork sausage is a finely ground mixture of lean and fat meat highly seasoned and flavored. Many sausage makers introduce some lean beef to give greater solidity. Commercial sausage is very likely to contain potato flour, cereal flour or meal. These materials cut down on both the cost and the shrinkage. Much of the lean meat as well as the fat comes from the trimmings in cutting up the carcass. Shoulders and sides if not too heavy may be made into sausage.

Materials.—Good pork sausage should contain sufficient fat to "fry itself." This condition is met by mixing lean and fat meat in the ratio of 1 pound fat meat with 3 or 4 pounds lean meat. For each 10 pounds of this meat 2½ ounces of salt, 2 tablespoonfuls black or white pepper and 2 tablespoonfuls of finely pulverized sage are required.

Preparation.—The meat is cut into small pieces and run through the sausage cutter or the food chopper, using the fine cutter. The other materials are added and thoroughly mixed by kneading with the hands.

Preservation.—There are several ways of preserving sausage, though as a rule most of it is consumed while fresh: (1) The partial cooking

method, which has been described; (2) the sausage may be packed tightly into earthenware crocks or jars and covered with melted lard, if stored in a cool place it will keep for weeks; (3) it may be packed into muslin pokes or bags about 2 or 3 inches in diameter these hung in a cool place will keep for some time or if smoked the sausage may be kept for months.

Scrapple ("Pon Hause")

Scrapple is regarded by many as one of the best by-products of pork. The meat is generally obtained by boiling the cleaned head, feet and other bony parts in sufficient water to cover until the meat will readily fall from the bones. The liquor is strained from the bones and meat and allowed to cool. The fat is removed and the clear stock saved. All meat is picked from the bones and either cut or picked into small pieces. For each gallon of the liquor or stock the following materials are required: 2½ ounces of salt, 1 ounce black or white pepper, enough cornmeal and buckwheat flour in ratio of 3 to 1 to thicken and 1½ to 2 pounds of the prepared meat.

Method of Making.—The liquor or stock is brought to boiling, the salt is added, then the mixture of cornmeal and buckwheat flour is added a little at a time with sufficient stirring to keep the mixture smooth. When it begins to thicken as in making mush or hasty pudding the pepper and prepared meat are added. Almost constant stirring is required for the first 15 or 20 minutes boiling to prevent burning. The heat is then reduced and slow boiling with sufficient stirring to prevent scorching is given for 40 to 60 minutes. The hot material is poured into shallow pans, when cold it is cut into thin slices and fried in fat. If melted lard is poured over the top of the scrapple it will prolong its keeping.

Head Cheese

Head cheese is usually made from the head and feet. The head (face part) is carefully cleaned and dressed. This together with other bony parts is placed in a vessel and covered with water. The vessel is covered and the bones are cooked at slow boiling until the meat will separate easily. The pot liquor is strained off and reserved. The meat is picked from the bones and either cut or picked into small pieces.

The prepared meat is returned to the kettle and enough of the pot liquor is added to just cover the meat. Salt and pepper are added to taste and the meat is cooked at slow boiling for 10 to 15 minutes. The meat is then poured into shallow pans. A cover and weight are added and the meat is set aside to solidify.

Pickled Pigs' Feet

The pigs' feet should be well scraped and have the toes removed. They are allowed to soak overnight in a weak brine (2 ounces salt per quart of water). The following day they are boiled slowly in water in a covered kettle until they are tender. They are removed from the fire, cooled, split lengthwise and packed into jars. They are covered with hot vinegar which has been spiced to taste.

Mincemeat

All home made mincemeat contains some lean beef or pork, usually the former. The amount and kinds of other materials may vary over a wide range. The following recipe will give a moderate priced product of very high quality. For each $2\frac{1}{2}$ pounds of beef allow $\frac{3}{4}$ pound suet, 8 pounds good apples, $\frac{1}{2}$ pound citron, $\frac{1}{8}$ pound candied orange peel, $1\frac{1}{2}$ pounds seedless raisins, 1 pound currants, 1 pint boiled cider, $\frac{3}{4}$ cup vinegar, 3 pounds sugar, 5 teaspoonfuls of salt, 1 teaspoonful of mace, 3 teaspoonfuls each of cloves and nutmeg and 5 teaspoonfuls of cinnamon.

Procedure.—The meat is cut into small pieces and cooked until tender, if in pressure cooker at 15 pounds cook for 30 minutes. It should cool before going through the food chopper. The fine cutter is used. The suet is trimmed and run through food chopper with the meat. The citron and orange peel are run through the chopper, using the fine cutter. The raisins and currants are washed and chopped with the medium cutter. The apples are washed, peeled and cored and run through the food chopper, using the coarse cutter. The spices and salt are mixed with the sugar. All the materials are thoroughly mixed, a pint of pot liquor from the meat is added and the mixture is set over the fire to cook. Almost constant stirring is necessary to prevent burning. It requires 10 to 20 minutes boiling to give the proper consistency. The hot product is filled into clean, dry jars, filling them full. The jars are partially sealed and processed in the water bath, pint jars for 30 minutes.

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CHAPTER XXIII

MARINE PRODUCTS

The home preservation of fish and other marine foods should be of interest to those who have a ready access to a supply of fresh materials. Fish and also some of the sea foods are highly perishable and only those who live along or quite near the coast should attempt to preserve these foods.

The common methods of preservation are canning, salting and manufacturing into products. Rarely will the home maker attempt to dry or smoke fish. The recipes which follow have been adapted from materials supplied by the Bureau of Fisheries, Department of Commerce.

CANNED FISH

Only fresh fish should be canned. They should be killed and bled as soon as caught. The scales are more easily removed if the fish are dipped for a moment into boiling water. If the skin is tough the fish should be skinned. The viscera and all dark membrane found in the abdominal cavity are carefully removed. In canning small fish the backbone is left in. If the fish are large it is removed. The dressed fish are placed in a brine (1 ounce salt per quart of water) in order to draw out all blood before packing. This requires 10 minutes to 1 hour, depending upon size of fish. The brine should be in sufficient quantity to cover the fish and should not be used with more than one lot of fish. If the meat is loose or soft it can be hardened by allowing it to soak in a 40° Salometer brine (4 ounces salt per quart of water). The time required will vary, according to size of fish, from a few minutes to one hour.

The fish are removed from the brine and drained well. They are cut into convenient size pieces for packing. The pieces are packed closely to within one-quarter inch of the top of container. A teaspoonful of salt is added to each No. 2 can or pint jar. The tin cans are exhausted under 10 pounds pressure for 10 minutes and sealed while hot. Glass jars are partially sealed.

Fish should be processed under 15 pounds pressure at a temperature of 250° F., No. 2 cans and pint jars 80 minutes.

SALT FISH

Large fish having soft fins, small scales and thin skin should be scaled, not skinned. The head is removed and the fish is split down the belly to the vent in order to remove the viscera. A cut is made on each side of the backbone inside the body cavity. The bone is cut off at the extreme back of the cavity and the cut off portion is removed. Another cut is made along one side of the backbone for the remaining length of the fish and the tail is cut off. If the fish are too large to go into the container they should be cut into the proper length.

Slender fish such as mackerel, large herring, etc., are cut down one side of the backbone for the entire length after removing the head. The viscera are removed through the split along the back. Coarse-scaled, thick-skinned, spiny-finned fish, like black bass, perch, etc., are skinned. Small fish may be eviscerated without splitting them.

The prepared fish are carefully washed in water containing a small amount of salt (1 cup per gallon of water) until thoroughly clean. They are then cured as follows:

A thin layer of salt is first placed over the bottom of the barrel or keg. On this is spread a layer of fish, one deep, a rather thick layer of salt is sprinkled over the fish. Another layer of fish and salt as above is added and so on until the barrel is filled or until the supply of fish is used up. Approximately 35 pounds of salt per barrel of fish will be required. The salt and the moisture from the fish will make a strong brine in which the fish should remain for a week or 10 days. At the end of that period the fish are removed from the barrel and washed in clear water. The brine is discarded, the fish are repacked in the cleaned barrel and are covered with a fresh brine made by dissolving 1 pound of salt in each gallon of water. After 1 week this brine is drawn off and discarded and the barrel is filled with a saturated brine, that is, salt sufficient so that a small amount remains undissolved in the water after prolonged stirring. (Approximately 2½ pounds of salt per gallon of water will be required to produce a saturated solution.) The barrel may then be headed up, or a false head is fitted inside and a weight is added to keep the fish submerged. At no time during storage should the brine be allowed to fall below the false head. The fish should be stored in a cool cellar.

OYSTERS

Only fresh oysters should be canned. It is therefore advisable to open oysters by hand. All oysters with partly open shell should be rejected. The shelled oysters are rinsed in clear water. Care must be given to avoid including small pieces of shell. The oyster meat is packed into lacquered tin cans or glass jars—16 ounces in No. 2 tin can and 14 ounces in a pint jar. Hot brine ($\frac{1}{4}$ pound to 5 quarts of water) is added to fill to within $\frac{1}{4}$ inch of the top. Tin cans are exhausted and sealed, glass jars are partially sealed; and either container is processed, No. 2 tin cans and pint jars 40 minutes at 240° F., or 10 pounds steam pressure.

CLAMS

Clams are canned in the same manner as oysters. If clams are muddy they should be given a thorough washing before they are opened. All broken or discolored clams should be discarded.

Clam Broth

The clams should be thoroughly washed before they are opened. The clam meat together with their liquid are placed in a vessel and cold water is added to just cover the clams. They are then set over the fire and boiled slowly for 10 minutes. The broth is strained off through a layer of good cheesecloth. The broth is returned to the saucepan and seasoned to taste with salt and pepper. One tablespoonful of butter for each 50 large clams is added. The broth is heated to simmer and filled into lacquered tin cans or glass jars. The tin cans are sealed while hot. The glass jars are partially sealed. The broth is processed, No. 2 tin cans and pint glass jars 40 minutes at 250° F., or 15 pounds pressure.

Clam Chowder

There are many methods of making a good clam chowder. The inexperienced canner may use the following recipe as a guide for manufacturing and preserving this delicious food.

For each 2 dozen large clams the following materials are required: 2 quarts hot water, 2 medium white onions, 2 branches of celery, 2 leeks, 2 slices of bacon—cut into dice, 3 large potatoes, peeled and cut into dice, 1 to 2 teaspoonfuls salt, $\frac{1}{4}$ teaspoonful pepper, 3 large tomatoes, 1 teaspoonful finely cut parsley.

The clams, onions, celery and leeks are all chopped. Size of pieces may be according to taste but are usually quite fine, the tomatoes are

boiled in their own juice for 5 to 10 minutes, then rubbed through a fine sieve to remove skins and seeds.

The bacon is heated and the onions, celery and leeks are fried in the fat, the juice drained from the clams, the water and potatoes are added and boiled for 10 minutes. The remaining materials, except the parsley, are then added and the mixture is again boiled slowly for 10 minutes. The parsley is added and the hot chowder is filled into No. 2 cans or pint jars. The cans are sealed while hot, the glass jars are partially sealed. The chowder is then processed, No. 2 cans and pint jars 40 minutes at 250° F., or 15 pounds steam pressure.

CANNED SHRIMP

Shrimp should be used only when absolutely fresh, as they deteriorate very quickly. They may be peeled or the shell may be left on until after they are cooked. In either event they are boiled in salt water, 1 pound of salt to 1 gallon of water. The shrimp should not be placed in the water until it is boiling. They are boiled 5 to 6 minutes. If they were not peeled before boiling they are drained well and sprinkled with a small amount of salt. The salt will harden the meat somewhat and the shrimp may the more easily be peeled. Shrimp should be packed into enameled tin cans or glass jars.

Wet Pack.—The prepared shrimp meat is packed into lacquered tin cans or small glass jars. The container is filled with a weak hot brine (1 tablespoonful salt per quart water) to within one-quarter inch of the top. Tin cans are exhausted for 5 to 10 minutes and sealed while hot, glass jars are partially sealed and processed, No. 1 tin cans and tall, narrow half-pint jars 15 minutes at 240° F., or 10 pounds pressure, No. 2 tin cans and pint jars or flat half-pint jars 30 minutes at 240° F., or 10 pounds pressure.

Dry Pack.—The prepared shrimp meat is packed into the containers, no liquid is added. Tin cans are exhausted 10 minutes and sealed while hot, glass jars are partially sealed. No 1 tin cans and tall half-pint jars are processed 60 minutes at 240° F., or 10 pounds pressure; No. 2 tin cans and pint jars—90 minutes at 240° F., or 10 pounds pressure.

CRAB MEAT

Crabs are most easily handled in the following manner. Baking soda is added to boiling water at the rate of $\frac{3}{4}$ ounce per gallon of water. The live crabs are dropped into this boiling solution and boiled for 20 minutes. They are removed from the hot water and thoroughly

washed in clear, cold water. All available meat is picked from the shell. Care must be taken to exclude small bits of the shell. The meat is washed in a weak brine (1 tablespoonful of salt per quart of water) it is drained well and packed moderately close in lacquered tin cans. The cans are exhausted for 10 minutes and sealed while hot; No. 1 tin cans are processed for 45 minutes at 250° F., or 15 pounds steam pressure. The cans must be cooled very quickly after processing in order to prevent discoloring the meat. Glass jars are not as well adapted to canning crab meat because of difficulty in rapid cooling after processing.

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CHAPTER XXIV

ACCESSORY MATERIALS

The homemaker and the commercial manufacturer of fruit and vegetable products both find many uses for accessory or added materials. Some of these are desirable or necessary in the preparation of products, others are relied upon as aids to preservation. The use of accessory materials does not necessarily mean that foods to which they have been added are undesirable. It does mean, however, in many cases that such foods have been adulterated, that is, they are not what are commonly called "pure foods."

The mere fact that a food product has been adulterated does not imply that it is less desirable. As a matter of fact there are numerous instances in which adulterated products are preferred to the pure product. The term "adulterated food" has, unfortunately, come to have a sinister meaning in the minds of many consumers. This should not be so because the Pure Food Laws (see Appendix B) permit the practice of only harmless adulterations and the consumer is protected against fraud by the label on the package which must declare the nature of the adulteration, if any. The Pure Food Laws are rigidly enforced and violators of its provisions do not long escape detection and punishment.

Accessory materials may, for convenience be classified as follows:

1. Preservatives.
2. Extenders.
3. Modifiers.
4. Sweeteners.
5. Colors.
6. Flavors.
7. Hardeners.

1. Preservatives.—Preservatives are substances which possess antiseptic properties, that is, they inhibit the growth of organisms present and thereby prevent spoilage. A good preservative must possess this antiseptic property to a relatively high degree; it must be harmless to the human system; it must not impart any undesirable color, flavor

or taste to the food; and it should be reasonably cheap and readily obtainable. Preservatives may be placed in two groups: (*a*) Common or kitchen preservatives and (*b*) chemical preservatives.

(*a*) *Common Preservatives.*—This group comprises materials that are commonly found in the home kitchen and that are in general use in the manufacture of fruit and vegetable products. They possess antiseptic properties and when used in sufficient quantities function as preservatives. They are: (1) sugar, (2) salt, (3) vinegar, (4) spices, (5) smoke. Sugar is the only one which is likely to qualify as an adulterant. When used in larger ratio than 55 pounds of sugar with 45 pounds of fruit, sugar is declared by federal law to be an adulterant.

(*b*) *Chemical Preservatives.*—Many chemical substances have great antiseptic properties but only a very few of them are permitted, by law, to be added to food products. Those most commonly used are benzoate of soda, borax, saltpeter, sulphur dioxide, and salicylic acid. Except for the use of borax on fish and saltpeter in curing pork, any other use of chemical preservatives must be declared on all packaged food. The substances placed in this group are those which any one would call to mind when " preservative " is mentioned in connection with food.

2. Extenders.—These are substances which are added in the preparation of a food for the purpose of spreading some desired character over a relatively large volume or for the purpose of reducing the cost of the finished product. As a general rule extenders are relatively cheap and since they are used to replace more expensive materials they are classed as adulterants. The use of apple juice or commercial pectins in making jellies, the addition of apple pulp or commercial pectins in the manufacture of jams, marmalades, etc., are familiar examples of the use of extenders. These are, as a rule, legitimate practices, but the addition of extenders constitutes adulteration as defined by law and the label of such foods must indicate the nature of the adulteration.

3. Modifiers.—A modifier is a substance added to a food material to supply some characteristic which is lacking. The two characters most commonly lacking are acid and pectin. If fruits have a low acid content it is quite common to add a small amount of some organic acid such as citric or tartaric. Apple juice and commercial pectins are used to give desired pectin content in the manufacture of jellies, jams and marmalades. Modifiers are adulterants and foods to which they have been added must be labeled to indicate the nature of the adulteration. The manner of indicating the adulteration depends upon the method of manufacture. If apple juice or similar juice is added to the juice of another fruit for the purpose of extending a desirable quality or

to correct some deficiency, the resulting jelly may be labeled as a blended product. For example, if apple juice and raspberry juice are mixed and made into jelly it may be labeled Raspberry-Apple Jelly. But if a commercial pectin is used in place of the apple juice the label must declare the presence of added pectin.

4. Sweeteners.—Sucrose or cane sugar is the common sweetener. It is not considered an adulterant except when used in excess of 55 pounds of sugar to 45 pounds of fruit.

Glucose is the common substitute for sucrose or cane sugar. It plays an important part in the manufacture of candies and confections. In the production of fruit products it is used in the manufacture of cheap jams, preserves and marmalades. It is a good wholesome food but whenever used to replace sucrose in the manufacture of fruit products its presence constitutes adulteration.

Saccharin is a coal tar product. It is said to be 500 times sweeter than sucrose, but it possesses no food value. It has been pronounced unsafe and its use in foods has been forbidden by law. Only the trickster and a few homemakers resort to the use of this material except as it may be prescribed by medical men.

5. Colors.—Two kinds of artificial colors are usually available. One of these is of vegetable origin while the other is derived from coal tar. Vegetable dyes are not permanent and their use should be limited to such foods as are intended for immediate or early consumption. The coal tar dyes are more permanent in character. They have been tested by the United States Bureau of Chemistry and are therefore harmless. They are often sold under the name of certified colors. The coal tar colors are much more satisfactory and their use is recommended. Foods to which color material has been added are adulterated and this fact must be stated on the label.

6. Flavors.—The flavoring substances may be divided into two classes: (*a*) *Condiments*—these consist of salt, pepper and vinegar; (*b*) *spices*—this group contains a large number of materials such as cinnamon, cloves, ginger, etc. The normal use of condiments does not, as a rule, constitute adulteration. The addition of pure spices to such foods as fruit butters, pickles, relishes, etc., does not constitute adulteration because such foods normally are made with spices in them.

Spices or the spice flavor may be introduced into foods in any one or more of three ways: (*a*) The spices themselves may be added to and become a part of the food; examples are mint leaves in jelly, cloves, cinnamon, etc., in pickles, fruit butters, etc. (*b*) They may be introduced in the form of an essential oil, such as oil of peppermint, oil of cloves, etc. (*c*) They may be used in the form of extracts which as a rule are

alcoholic solutions of the essential oils, such as extract of peppermint, extract of cloves, etc. The use of oils and extracts may constitute adulteration. There is some advantage in using the extracts of spices since there is less color added to the foods. The oils are so highly concentrated that their use except in quantity production is extremely difficult.

7. **Hardeners.**—There are three commonly used hardeners. They are sugar for fruits and salt and alum for vegetables. The use of sugar and salt does not constitute adulteration. The use of alum, which is permitted by law in pickle making, is an adulteration and when used it must be so declared on the label.

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CHAPTER XXV

JUDGING CANNED AND MANUFACTURED FOODS

Judging the relative merits of foods is at best a difficult thing to do. The standards for judging such raw materials as fruits, corn, vegetables, etc., are fairly well defined and the scoring of these presents fewer difficulties because personal opinion cannot play a very important part. We have, however, no such established standards for judging foods. Consequently the judging of them has always been done in a more or less hit or miss manner, each judge using his own ideals as his standard.

FIG. 59.—An educational exhibit of food preservation equipment.

If progress is to be made in judging and in developing our present rather meager displays of manufactured and canned foods the first step is to standardize these food products.

Effects of Standardization.—Standardization will be of great educational value to both the producer and the consumer. Exhibits of high quality products will stimulate the consumption of fruit and vegetable products. It will not only stimulate consumption alone but it will also encourage many to engage in the work of preservation. No other single thing will do more to increase the preservation of food and its subsequent consumption than well-staged and properly judged exhibits.

A rational standard discourages all practices which detract from the highest quality and food value. The introduction of preservatives and

unnecessary or harmful adulterants would disqualify an exhibit, while the use of legitimate adulterants or extenders would be permitted and encouraged insofar as they did not affect the food value or impair the quality of the resulting product.

The standard would also go far toward standardization of methods of production and this is certainly something worth attempting. The method of manipulation is an important factor in determining the quality and value of the resulting product, whether it be a jar of string beans or a glass of jelly.

Main Points to be Considered.—In judging horticultural manufactured food products there are certain things which should receive special attention because of their influence in contributing to the value of the particular food under discussion. These fundamental characters will form the skeleton of a score card and will constitute a guide to the exhibitor in preparing his exhibits and will be used by the judge in making his awards. Those to which special importance is attached are as follows:

1. *Appearance.*—The appearance of any food has a very high psychological value. If attractive it predisposes the observer or probable consumer in its favor. This is of especial significance where foods are intended for sale. However, its value in foods intended for home consumption should not be underestimated.

The appearance of foods in glass containers is a fair to good indication of their quality. In most cases the experienced observers will be able to form very definite notions concerning the condition of the raw materials used, the care and cleanliness practiced in preparation, the general method employed, the skill of the operator in applying those methods, and the condition of the finished products as they stand in the exhibit.

2. *Condition.*—The condition of the preserved food will indicate in a large measure its quality and usefulness. There must be a fairly definite understanding as to what shall constitute an ideal condition for each group of products. These standards must be in harmony with the fundamental principle that these foods are intended for human consumption and therefore must meet the demands imposed by the consumers, or better still they must be in line with progress and improvement.

The standard requirements are so many and varied in order to meet the conditions imposed by a wide range of both fruit and vegetable products that it is unwise to attempt a lengthy discussion of this point, but rather to leave the establishment of the standards for condition to the individual score card.

3. *Quality.*—Appearance and condition tempt the customer to purchase his first package, or induce the consumer to risk the first helping. But it is the quality of the product that brings the customer back for more packages and tempts the consumer to ask for a second helping.

There can be no absolute standard quality—no matter how much we may prate about it. Too many things enter into the formation of quality and individual judgments are at too great a variance. What suits A as high quality jam is refused altogether by B, because it is too sweet. There is, however, a middle ground and the experienced judge must be able to base his findings upon this plane—upon a general average of those characteristics which combine to form quality. (See page 101.) He must know how to balance these characters without unnecessary prejudice.

4. *Containers.* The container is an important factor whether foods are to be exhibited, sold, or consumed in the home. Certain characters of containers are to be emphasized for exhibition that would not be so essential if to be used only in the home.

Containers should be economical. The use of expensive containers for exhibit purposes should be discouraged. They should be efficient for the type of product they contain. Their size should be adapted to the type of product and the method of preservation. If for market the smaller packages are generally given preference. If for home use, the size may be and often is, determined by the size of the family.

It is highly desirable that the containers in any one particular class should be uniform in size and type. Exhibits from farm factories should be scored off for lack of uniformity while in case of the home-maker the requirement should be more flexible, allowing her to exhibit such containers as she may have on hand so long as they are economical and efficient.

It is desirable that containers should be of clear glass rather than of the miserable hues of green and blue so frequently used. An exception to this might be made in favor of using green glass containers for a few of the green vegetables.

5. *Label.*—The label should be small, neat, accurate and attractive. It should meet the requirements of both the state and federal pure food laws. It should carry the name of the product, the net weight of the contents, a declaration of materials used and the name and address of the one who canned or manufactured the products.

Any misrepresentation of products should serve as a bar to competition and the exhibit should be so labeled or removed from the show.

HOW SHALL WE JUDGE?

In order to discuss this phase of the judging it will be necessary to make some rough classification of food products. Exhibits will naturally divide themselves into two classes, viz., manufactured products and canned products.

The manufactured products as a group are in condition for consumption without further preparation. The qualities for which each is valued are supposed to be present and all admit that we cannot judge this quality by observation alone. Furthermore, because of the processes to which these manufactured products have been subjected they are in a condition which prohibits immediate spoilage following the opening of containers. It would seem then that such products as jams, jellies, preserves, butters, marmalades, conserves, pickles and relishes should be judged both by observation and through sampling. Such sampling properly done will not entail any serious loss to the exhibitor, nor need it detract from the educational value of the exhibit nor disqualify the product from subsequent exhibition.

The canned fruits and vegetables are an entirely different problem. Practically all canned vegetables must undergo some preparation between the container and the plate of the consumer and it is this preparation which develops the true flavor and the quality for which that particular vegetable is esteemed.

Fruits are canned for dessert purposes or for culinary uses. Those intended for dessert purposes are canned with sugar or sugar syrup. The amount of sugar used varies greatly according to the kind of fruit and the ideals of the canner. Those intended for culinary uses may be canned in light syrups, water, fruit juice or without the addition of anything. These fruits are not intended for consumption without some secondary preparation. They may be used for pies, puddings, cakes, etc., or may be sweetened and served as dessert. Fruits canned for dessert purposes should if properly sweetened possess high fruit quality, while those canned for culinary uses are in the same class as canned vegetables since they require some preparation to develop the quality inherent in them.

It is therefore a bad practice to lay down a general rule that all canned fruits and vegetables must be judged from sampling. The general rule should be against the wholesale and indiscriminate opening of containers, exceptions to this rule being made to permit the judge to open packages in which he may have reasons to suspect spoilage or fraud.

There are many arguments in favor of this rule. One of the most serious objections to be raised against the practice of sampling canned foods is the wanton waste of good food with no adequate recompense. Where exhibits must remain in place from 3 to 6 days, total loss will result from practically all packages opened. The unsightliness of fermenting fruits and other canned foods is poor psychology, and our chief aim in staging exhibitions—education—is lost. It is more than lost because such exhibits breed timidity and fear in the minds of the inexperienced observer, while the experienced canner will gain little or

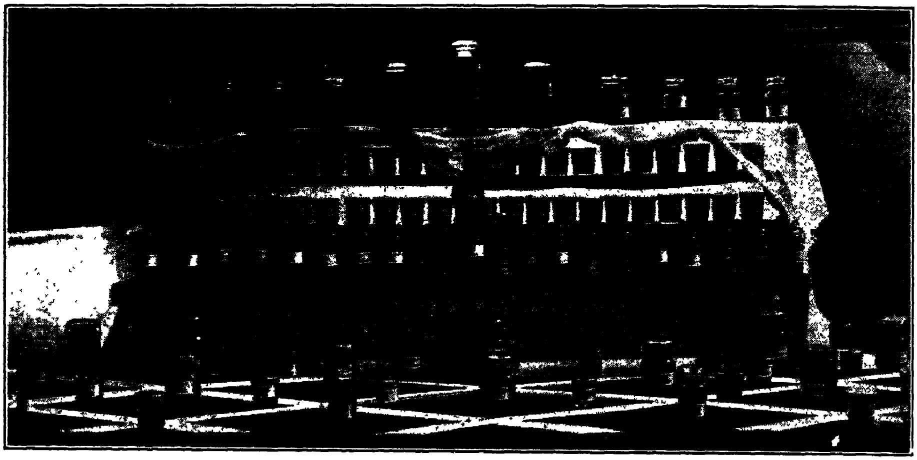

FIG. 60.—A student's exhibit.

nothing from an exhibition of fermenting and decaying fruits and vegetables.

We cannot expect housewives and others to become enthusiastic supporters of exhibits if they know their canned fruits and vegetables are to be opened and subsequently spoiled simply to satisfy the whim of a judge who imagines that his taste organs alone can decide if A or B has the best jar of spinach or blueberries.

Standards.—The following score cards and standards are offered to exhibitors as a general guide to the preparation and selection of their products for exhibition; also to judges as a basis for uniform judging of exhibits. They are intended to express practical rather than ideal standards. Their mission is to raise the standard of finished products and to unify methods of judging. No claim is made that they are perfect nor that the points, in all cases, have been equitably distributed, but they have been approved by a large number of persons trained in food work.

CANNED FRUITS

Fruits may be canned whole, in pieces or as pulp. Personal preference may determine the condition of the fruit as it goes into the package; for instance, cherries may be pitted or not pitted, plums may or may not have the skins removed, etc.

Fruits are canned primarily for dessert or culinary uses. Those intended for dessert are usually sweetened ready to serve. They may be canned in a suitable sugar syrup or by addition of sugar only. Those intended for culinary purposes may be canned in water or fruit juice, without anything being added, or in the same manner as those intended for dessert.

Score Card

1. Appearance		20
2. Condition of fruit		30
3. Pack		40
(a) Uniformity	10	
(b) Proportion of liquids to solids	15	
(c) Solids	15	
4. Container		10
		100

1. Appearance.—The appearance of canned fruits should be attractive, showing clean and careful preparation of materials. The liquids should be reasonably clean and of good color. The fruit should have its characteristic color, and should fill the jars at least to the neck. The amount of sediment in the bottom of the jars will vary with the different fruits and with methods used but should not be excessive.

2. Condition.—Those canned whole or in pieces should retain their original shape and be practically free from pulp and crushed or broken fruits.

When canned in sugar or sugar syrup the amount of sugar used must not be such as to obscure the natural fruit flavor but rather blend with the acid of the fruit to give the product that rich sub-acid taste and fruit flavor for which canned fruits are prized. Nor must the sugar be in such quantity as to cause the fruit to shrivel and float. This floating of the fruit does not apply to those few, soft-fleshed ones which naturally shrink when heated.

When canned in a liquid there should be practically no crushed or broken fruits. The fruit or pieces should be of original shape with a minimum amount of shrinkage. If canned with sugar only, or without anything being added, the amount of crushed and broken fruits will

vary with the kind of fruit and the care in handling, but should never be in excess.

3. The Pack.—(*a*) *Uniformity.*—The fruits or pieces should be of a reasonably uniform grade and size.

(*b*) *and* (*c*). *Liquids and Solids.*—When syrup or other liquids are added to whole fruits or pieces there should be a maximum amount of solids. They should fill the jar at least to the neck and should not (except as noted under " condition ") float from bottom of jars indicating excess of sugar, slack packing or over-processing. The liquid should practically cover the solids.

When canned with sugar or without anything being added the solids should fill the jar to the neck and the liquid must practically cover the solids. Fruits should not float except as noted under " condition "—when canned as pulp the jar should be filled at least to the neck and should have the smallest amount of liquid compatible with proper processing.

4. Containers.—The containers should be attractive, practical, economical, and efficient. Clear glass is preferable since the natural color of contents is shown. Each exhibit should consist of jars of the same type and make. The labels should be neat and accurate.

COLLECTION OF CANNED FRUITS

Score Card

1. Attractiveness		20
(*a*) Arrangement	10	
(*b*) Containers	10	
2. Choice of products		25
3. Conditions		20
4. Pack		40
		100

1. Attractiveness.—(*a*) *Arrangement.*—The exhibit should show taste and care in arrangement. The kinds of fruits and number of packages must conform to the rules of the exhibition. (For details regarding appearance of individual jars see discussion under canned fruits.)

(*b*) *Containers.* (See canned fruits.)

In judging a collection, preference is to be given in favor of most valuable home grown or native fruits making up the collection.

CANNED VEGETABLES

Vegetables may be canned whole, in pieces or as pulp and, depending upon the kind and method used, they may be canned in their own juice or (except tomatoes) in water. Small quantities of salt, vinegar, sugar or lemon juice may be added but no chemical preservative will be tolerated.

FIG. 61.—Educational exhibit of canned and manufactured foods.

SCORD CARD

1. Appearance		15
2. Condition of vegetables		35
(a) At time of canning	15	
(b) The finished product	20	
3. Pack		40
(a) Uniformity	10	
(b) Proportion of liquid and solids	15	
(c) Solidity	15	
4. Container		10
		100

1. Appearance.—The appearance of canned vegetables should be attractive, showing clean and careful preparation of materials, proper processing and the use of the material at the proper stage of maturity.

2. Condition.—(a) Vegetables should be canned at the proper

state of maturity. If too old the pieces of vegetables will be large, tough, and woody. If too young they are undersized, watery and likely to be pulpy.

(*b*) They should not be over-processed to the extent that the color is injured nor to cause undue softening or breaking up of the vegetables. The liquid should be reasonably clear and the amount of sediment or pulp in the bottom of jars of vegetables canned whole or in pieces must not be in excess. Those canned as pulp should not have the liquid in excess of the amount required to insure proper processing.

3. The Pack.—(*a*) The proper grading with respect to size and color is of some practical value besides adding very much to the attractiveness of the package. And while it is advisable that a reasonable amount of grading shall be done in order to secure best results this point should not be over-emphasized with certain products such as tomatoes.

(*b*) The solids should fill the jar at least to the neck, and when canned whole or in pieces the liquid should practically cover the solids. Jars in which the liquid stands much below the surface of the solids should be scored off since this indicates wrong methods of preparation, or packing, or improper processing. When canned as pulp there should be a minimum amount of free liquid.

(*c*) Jars should contain a maximum amount of solids compatible with proper processing. Preference should be given to utility packs rather than to fancy packs. The solids should show only a minimum amount of shrinkage after packing.

4. Container.—(See 4, under canned fruit.)

COLLECTION OF CANNED VEGETABLES

Score Card

1. Attractiveness		20
(*a*) Arrangement	10	
(*b*) Containers	10	
2. Choice of products		25
3. Condition		20
4. Pack		40
		100

1. Attractiveness.—(*a*) *Arrangement.*—The exhibit should show care and taste in arrangement. The kinds of vegetables and the number of jars must conform to the rules of the exhibition. (For details regarding appearance of individual jars see discussion under canned vegetables.)

(*b*) **Containers.** (See 4, under canned fruits.)

2. Choice of Products.—In judging a collection of canned vegetables preference should be given to those of most practical value.

3. Condition and Pack.—(See canned vegetables.)

FRUIT BUTTERS

Fruit butters are made from the pulps of fruits. Usually only the fleshy fruits are made into butter. Like jellies they have two distinct uses. They may be used as a spread for bread, in which case they are sweetened to a mild sub-acid taste; or they may be used as a relish with meats and vegetables, in which case they may be sweetened only a little or none, the taste being distinctly tart to acid. Spices may or may not be used. When present they should be evenly distributed and should not be in such amounts as to obscure the natural fruit flavor.

Score Card

1. Appearance	15
2. Consistency	35
3. Flavor and taste	40
4. Container	10
	100

1. Appearance.—Fruit butters should have a clean, characteristic color. The color and texture as seen through the glass should be attractive and appetizing.

2. Consistency.—The consistency of a good fruit butter very closely approaches that of well-worked dairy butter. It should be smooth, of fine grain, free from lumps, skins and seeds, with no free liquor. It should spread easily.

3. Flavor and Taste.—The flavor should be characteristic of the fruit from which it is made. Spices and sugar should not be used in such quantities as to obscure the fruit flavor but should rather blend with it to produce a more pleasing and appetizing flavor and taste.

The taste should be sub-acid to acid, never distinctly sweet. (See 4, under canned fruit.)

CONSERVES

Conserves are usually made from a mixture of fruits with the addition of nut meats. The fruit that gives the name to the conserve should be the dominant factor in the taste and flavor. The other fruits and the nuts merely blend with the dominant fruit to produce a more pleasing product. A part or all of the fruit usually appears in slices,

shreds or pieces while the nut meats are generally in small pieces rather than finely ground.

SCORE CARD

1. Appearance	15
2. Choice and proportion of materials	10
3. Flavor and taste	35
4. Consistency	30
5. Container	10
	100

1. Appearance.—The appearance of a conserve should be attractive. The materials should be uniformly distributed, and the color should be characteristic.

2. Choice and Proportion of Materials.—The choice and proportion of materials should be such as to result in a well-blended flavor in which the dominant fruit may be easily recognized.

3. Flavor and Taste.—The flavor should be a pleasing blend of fruits and nuts with the major fruit dominating. The taste should be mild sub-acid. Spices should not be used to excess.

4. Consistency.—The consistency should be jam-like with no appreciable amounts of free liquor or such liquid as is present must be a heavy syrup. The nut meats must not be cooked enough to cause their oil to appear on the product.

5. Container.—(See 4, under canned fruit.)

JAMS

Jams are normally made from the small fruits. They are characterized by containing the entire fruit. The whole fruits are cooked with sugar to the desired consistency. Spices may or may not be added. Unlike jellies and butters, jams are used almost altogether as a spread, rarely as a relish. Jams are, as a rule, made from a single kind of fruit, but combinations of two or more kinds are not only permissible but often desirable.

SCORE CARD

1. Appearance	20
2. Consistency and texture	30
3. Flavor and taste	40
4. Container	10
	100

1. Appearance.—Jams should have an attractive appearance. The color should be characteristic. The color, texture and consistency should combine to indicate a product of high quality. In no fruit product does the amount of sugar used influence the general appearance more than in jams. Excess sugar develops intensive color while lack of sugar gives a pale unattractive color and the general appearance is poor.

2. Consistency and Texture.—The consistency of jams should be almost the same as that of a good fruit butter, that is, there should be little free liquor if the texture is uniform. When liquor is present it should be in the form of a heavy syrup.

The texture of jams will vary over a fairly wide range depending upon: the kind of fruit used, the method of manufacture, and the ideals of the manufacturer. They may be almost smooth with a fine grain (except for the seeds) or they may contain a part of the fruits practically whole, in shreds or in fairly large pieces. No hard and fast requirement for texture can be laid down.

3. Flavor and Taste.—The flavor should be characteristic of the fruit of the combination of fruits used. The addition of sugar or other substances should be in such quantities as to develop the highest possible fruit flavor. Caramel flavor due to long, slow cooking should not be present. The taste should be sub-acid in order to develop the high quality and flavor of the fruit.

4. Container.—(See 4, under canned fruit.)

JELLIES

Jelly is the product of cooking a fruit juice or a mixture of fruit juices with sugar (except cider jelly) until the concentrated juice sets or jells when cold. Combinations or blends of fruit juices either for the purpose of securing an improved flavor, to reduce the cost of manufacture or to correct the acid or pectin content shall not be construed as an adulteration for exhibition purposes provided the jelly is properly and accurately labeled.

Score Card

1. Appearance		20
Color	10	
Clearness	10	
2. Consistency		30
3. Flavor and taste		40
4. Container		10
		100

1. Appearance.—The general appearance of jellies should be attractive. The glasses should be clean with neat attractive covers. The paraffin cap when used should not show beneath the lower edge of the cover.

(*a*) *Color.*—The color of the various kinds of jellies has a wide range varying from almost colorless through amber, pink, red, purple, to black, depending upon the kind of fruit and methods used in manufacturing. The color should be attractive and characteristic of the fruit from which it was made.

(*b*) *Clearness.*—Clearness is somewhat dependent upon color when the jelly is viewed in the glass container. The lighter colors should be transparent to translucent while the darker colored ones are practically opaque. Insofar as possible to determine, jellies should not be cloudy and they should be free from pulp, crystals, sediment or precipitate of any kind.

2. Consistency.—A jelly should be tender, easily cut with a knife or a spoon, leaving sharp, clearly defined angles. It should retain its shape when removed from the container. It must not be sticky, syrupy, nor gummy.

3. Flavor and Taste.—The flavor should be characteristic of the fruit if made from a single fruit. Where made from a combination of fruits the flavor should be a pleasing blend of the fruits used. The fruit flavor must not be obscured by excess of sugar nor should there be a distinct flavor of caramel.

The taste should be sub-acid to acid depending upon the use to which it is intended. Jellies intended for use as a relish should be tart to acid, while those intended for use as a spread should be mildly sub-acid.

4. Container.—(See 4, under canned fruits.)

COLLECTION OF JELLIES

Score Card

1. Attractiveness		20
(*a*) Arrangement	10	
(*b*) Containers and labels	10	
2. Variety		20
3. Condition		60
(*a*) Color	10	
(*b*) Consistency	20	
(*c*) Flavor and taste	30	
		100

1. Attractiveness. (*a*) *Arrangement.*—The arrangement of the exhibit should show care and taste. The number of packages and kinds should conform to the rules of the exhibition.

(*b*) *Containers, etc.*—The containers should be uniform, attractive, practical, efficient, and economical. The jars should be filled at least to the lower edge of the cover. Glasses should be clean and of clear glass. The labels should be neat and attractive and must be accurate.

2. Variety.—Emphasis should be given to jellies made from our common varieties and kinds of fruits.

3. Condition.—(See discussion (*a*), (*b*), (*c*), (*d*), under " Jelly.")

MARMALADES

Marmalades are as a rule made from the pulpy fruits. The pulp and juice only or the entire fruit except core and seeds may be used. The skins, when used, and the pulp occur in the finished product in slices, shreds or small pieces and they must be evenly distributed. They may be made from one kind of fruit or from two or more kinds properly blended.

Score Card

1. Appearance		25
(*a*) Color	5	
(*b*) Clearness	10	
(*c*) Evenness of distribution	10	
2. Consistency and texture		25
3. Flavor and taste		40
4. Container		10
		100

1. Appearance.—(*a*) *Color.* The color should be characteristic of the kind or kinds of fruits used. It should be attractive.

(*b*) *Clearness.*—Marmalades are made up of two distinct parts; the solids and the more or less congealed liquids. There should be no apparent cloudiness. Both the solids and congealed liquids should be translucent to transparent in the light-colored fruits.

(*c*) *Distribution of Solids.*—The solids must be evenly distributed and should not be of such size or shape as to be unsightly.

2. Consistency and Texture.—The consistency should be soft or jelly-like. It should spread easily and should not contain an appreciable amount of free syrup. The texture may vary from fine to coarse.

A part or all of the fruit may be in shreds, slices or chunks. The individual pieces should be soft and tender.

3. Flavor and Taste.—The flavor should be characteristic of the fruit or a pleasing blend of the two or more fruits used. It must be free from caramel or strongly overcooked flavor. The taste should be mildly sub-acid.

4. Container.—(See 4, under canned fruits.)

PICKLES

Pickles in a broad sense may be either fruit or vegetable products. They may consist of a single fruit or vegetable or of two or more fruits or vegetables. The fruit or vegetable may be whole or in pieces. Pickles are characterized by having vinegar as the chief preservative agent. They may be sweet or sour in taste and the flavor may be that of the fruit or vegetable or it may be modified or almost obscured by the addition of spices. Vegetable pickles may have their color and flavor modified by the fermentation of the products in the first stage of their preparation. Vegetable pickles are also often named from the spice which dominates the flavor as mustard pickles, dill pickles, etc. Others are named from the one or principal fruit or vegetable.

Score Card

1. Appearance	10
2. Choice and proportion of materials	15
3. Flavor	30
4. Condition	15
5. Pack	20
6. Container	10
	100

1. Appearance.—Pickles should have an attractive and appetizing appearance. The color should be characteristic for the kind.

2. Choice and Proportion of Materials.—In mixed pickles the choice and proportion of materials should be such as to give a well-flavored, high-quality product; in the case of unmixed pickles the weight of score will be given on choice of fruit or vegetable used.

3. Flavor.—The flavor of the vegetable pickle should be characteristic of the type. It should be an appetizing blend of the vegetables and the pickle solution.

The flavor of the fruit pickle should be characteristic of the fruit blended with the pickle solution.

4. Condition.—The fruit or vegetable should be plump and tender, not shrunken tough nor flabby. Vegetables should be firm and crisp.

5. Pack.—There should be as large a proportion as possible of solids to liquids. The jars should be filled at least to the neck and the liquid should practically cover the solids. The pack should be solid, showing careful handling and minimum shrinkage. Fancy packs, though more attractive than good practical packs, should not be given undue weight in scoring.

6. Container.—(See 4, under canned fruits.)

RELISHES

Relishes include a rather large group of products each having its own special characteristics. They differ so widely in their composition, flavor and taste that it is difficult to make any logical grouping without having a large number of groups. The accompanying score card and standard are offered only as a general guide to the judges and to the manufacturers of the various kinds of relishes.

Score Card

1. Appearance	15
2. Choice and proportion of material	15
3. Condition	10
4. Flavor and taste	30
5. Pack	20
6. Container	10
	100

1. Appearance.—Relishes should have good, characteristic color and the general appearance should be attractive and appetizing.

2. Choice and Proportion of Materials.—In those relishes made up of a mixture of materials preference should be given to those in which the combination is such as to produce highest quality and most characteristic taste and flavor. When but a single fruit or vegetable is used preference should be given to the one of greatest value.

3. Condition.—Relishes should possess the general characteristics of their respective groups, that is, catsups should be of even, fine-grained texture while piccalilli, chow-chow, etc., should consist of finely cut pieces of fairly uniform size. These groups should not be pulpy, but the vegetables should be firm and crisp.

4. Flavor and Taste.—The flavor of all relishes should be characteristic of its kind, it should be appetizing, emphasizing the main ingredient

but free from all undesirable flavors. The taste should be characteristic of the kind of relish varying from sub-acid in some to acid in others.

5. Pack.—The package should be reasonably well filled. In those kinds where solids and liquids occur the proportion of solids should be as large as practicable and the liquid should practically cover the solids.

6. Container.—(See 4, under canned fruits.)

CHAPTER XXVI

DRYING AND EVAPORATION

Dried and evaporated foods are those which, by artificial means, have had their water content reduced to such a degree that they may be stored indefinitely. If the food materials are exposed only to the drying effects of the sunshine and air the process is called drying and such foods are dried foods. If artificial heat is employed to reduce the water content the process is called evaporation and technically at least these foods are evaporated foods. These two terms, however, are used interchangeably except where legal and scientific distinctions are made.

The drying and evaporation of fruits and vegetables in the home, on inexpensive equipment offers a very economical means of preserving many of the perishable and less perishable foods. Many of the dried or evaporated foods are as palatable and generally more nutritious than when canned. As compared with canning, evaporation is much the less expensive means of preservation. Dried foods, however, must undergo a preliminary treatment before cooking them for use on the table and this together with the cooking necessary to make the food palatable is the argument against evaporation. The canned corn is ready to serve after the precautionary 5 or 10 minutes' heating, whereas the dried corn must stand in water for several hours, after which it must be given a long cook. But even with these handicaps dried foods should find a place in the family menu because of their actual food value, their variety and the economy of their production.

Principles of Drying and Evaporation.—In order to operate, intelligently, even the simplest equipment, the operator should understand the fundamental principles which underlie the art and science of these methods of food preservation.

Properly prepared food materials dry or lose their excess moisture only when relatively dry air comes into contact with them. There is a limit to the amount of moisture a given volume of air can absorb. Therefore if the drying process is to progress beyond a certain point the air surrounding the food materials must be changed. Heating the air dries it, that is, the moisture carrying capacity is increased. Air at

32° F. will absorb $\frac{1}{160}$ part of its weight of moisture. This capacity is doubled with each increase in temperature of 27° F.; for example, air at 59° F. will absorb $\frac{1}{80}$ part of its weight, etc. Warm air therefore will absorb and carry away more moisture from food materials than will air of a lower temperature. It naturally follows then if food materials are to be evaporated quickly and uniformly it is very desirable, even necessary, to have currents of warm or dry air passing over them.

Critical Temperature.—The critical temperature is that degree of heat above which the food material will deteriorate. It varies with different materials. The range is 100° to 190° F. Most materials should be evaporated in the range 100° to 150° F. As a general rule the higher temperature should be applied only during the last stage of the process. If the temperature of the air is too high, that is, if the air is too dry, during the initial stage of evaporation the exposed surface of the food materials becomes seared or overdried. This checks the flow of internal moisture to the surface and thereby delays the process.

Another principle involved in drying has reference to the condition of the materials themselves. The smaller the pieces and the thinner they are spread over a given area, that is, so that the pieces do not over-lap or form a deep layer, the more rapidly will the moisture escape. It may not always be desirable to have such small pieces. The materials should be prepared in as small pieces as is consistent with the use for which they are intended. Vegetables intended for soup mixtures may be sliced very thin or even shredded or chopped, whereas if desired to be used as a vegetable dish it would be better to make the slices thicker. The principle, however, still holds true that mateirals in very small pieces spread thinly and dry more uniformly and rapidly.

SUN DRYING

Drying food materials in the open or in the sunshine is the oldest and most primitive method of food preservation. When properly managed the resulting products are satisfactory and it is by far the most economical method of food preservation known. In the west and southwest sections of this country large quantities of fruits and some vegetables are preserved in this way. This is possible because of the long periods of clear, dry weather which prevail in those sections. In the more humid regions sun drying becomes hazardous and in many places impossible because good " drying days "—days during which the atmosphere is capable of taking up appreciable amounts of moisture—are few and often none for long periods of time.

Method of Procedure.—In brief the method is as follows: The prepared fruits and vegetables are spread in thin layers on a platform, trays supported a foot or more above ground, or on a low, flat shed roof. They are covered with cheesecloth or mosquito netting to exclude insects and at least a part of the dust, and are left to the action of the sun and winds until dry. A covering should be given at night if dew is likely to form, and when rain threatens the trays are carried indoors and placed in a dry, well-ventilated room. A screened piazza may be used for those green-colored products whose color is seriously affected by direct exposure to the sun.

It is highly desirable that the period of exposure shall be as short as possible. Long periods of drying tend to develop a dark color while very slow drying may permit chemical changes to take place in the moist materials such as to impair seriously the usefulness of the food.

EVAPORATION

Evaporation is a more rapid process than is drying. The finished products have a better color and there is less deterioration of the food. The process goes on regardless of weather conditions and it is not restricted in its application by either weather or climatic conditions.

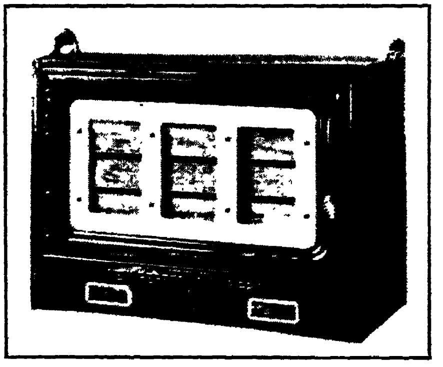

FIG. 62.—The portable oven makes a good evaporator. The door is left part way open to insure free circulation of air.

The Oven.—The oven offers the most economical means of evaporating fruits and vegetables in the home. When properly manipulated the oven will turn out high grade products in quantity sufficient for ordinary family requirements. As a rule trays are the most desirable receptacles for the prepared materials. These may be made from the fine-meshed ($\frac{1}{4}$-inch) cellar window wire which may be purchased from the hardware dealer. This wire is cut into pieces about 2 inches larger each way than the dimensions of the oven (depth and width). The extra width is bent over and back upon the sheet to a width of one inch on all four sides. This reduces the sheet of wire mesh to the size of the oven and the inch of bent over wire acts as a reinforcing along the sides and ends which gives the sheet a measure of rigidity. Or wood frames may be made of size to fit the oven and the woven wire is then used to

form the bottom of these trays. The sides of the trays are made from strips $1\frac{1}{2} \times \frac{1}{2}$ inch and the ends from strips $\frac{3}{4} \times \frac{1}{2}$ inch. These trays may be stacked one above the other in sufficient numbers to fill the oven. The $\frac{3}{4}$-inch opening at the two ends of the trays will allow ample circulation of air over the materials in the trays. Cheesecloth may be spread over the bottom of these trays when the materials are in small pieces.

In using the oven as an evaporator the door must be left ajar so that the warm moist air can escape and cooler air enter, which in turn becomes heated and dried and which then may take up its load of moisture from the drying materials. This constant circulation of warm air so essential to proper evaporation of foods cannot take place in the oven unless the door is partially open. An occasional rearrangement of the trays will generally be necessary in order to secure uniform drying throughout the oven.

All types of ovens may be used, though some are more desirable than others. The portable oven is very good since its construction is almost identical with that of the ordinary type of kitchen range evaporator, except that no provision is made for the ready escape of the warm moist air. When it is used for drying the door must be left slightly open. A little experience in oven evaporation will enable any one to operate the oven successfully in such manner as to produce high grade evaporated foods.

Suspended Trays.—Wire-bottom trays of convenient size may be suspended over the kitchen range by means of a cord passing through a pulley fastened to the ceiling or a makeshift crane attached to the warming closet or to the wall. Two or more trays may be attached, one beneath the other. When the range is required for cooking the trays may be lifted off or raised out of the way.

The Kitchen Evaporator.—There are several types of kitchen evaporators available. Some are designed for use over a wood or coal range or over a flame heater. Others are adopted for use over the range only. The chief difference between these two types is that those which may be used over any kind of heat have a partial metal bottom so attached, just below the first tray, that the heated air is deflected in such a manner as to give a fairly uniform distribution throughout the evaporator. This insures rapid and even evaporation. The other type does not possess this heat deflector and should not be operated over a gas or oil flame, unless a piece of sheet metal of sufficient size to function as a deflector is placed beneath the evaporator.

The Water Tank Type.—This is a very satisfactory piece of equipment for home evaporation. It requires least attention of all and gives very uniform and satisfactory results: They may be constructed

of tin plate or galvanized sheet iron. They may be made in size to suit the convenience or demands made upon them. They are a rectangular metal box of which there is a single opening, about one inch in diameter in one corner. The top is set in about three-quarters inch from the top of the sides and ends. A small size—that will handle a peck of beans or 100 ears of sweet corn—is about 16 inches wide, 30 inches long and 3 inches deep.

This evaporator is operated by filling it about half full of water. It may be placed over the range or the end away from the hole in the top may be placed over the flame of the oil burner or gas plate. The prepared materials are distributed over the top in a uniformly thin

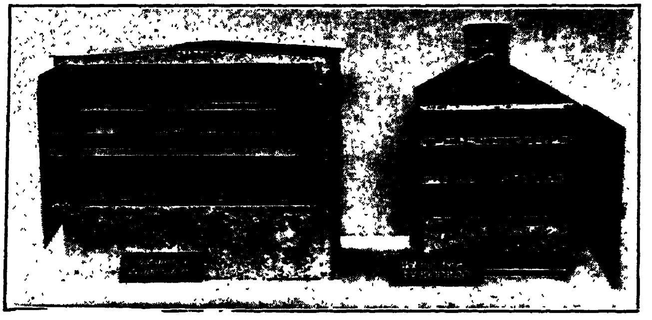

FIG. 63.—Types of small kitchen evaporators.

layer. As the water becomes heated it circulates throughout the entire volume which gives a fairly uniform temperature to the entire top surface upon which the materials rest. The opening in the corner allows the vapor to escape and is used for filling and emptying the water into and from the evaporator. The temperature of the water should be kept below the boiling point.

A single or double layer of cheesecloth placed on the drying surface of this evaporator under the materials adds to its efficiency and is a great aid in handling the finished products.

If products are dried in small lots of a few pounds the home maker may well substitute the " double pan " drier for the above type. The lower pan should be deep and rather narrow. The upper pan should be rather wide and very shallow or a cake tin may be used in place of the upper pan. Water is placed in the lower pan and the materials to be dried are spread thinly over the bottom of the upper pan. Heat is applied to bring the temperature of the water to 150° to 180° F. The source of heat may be the range or gas or oil flame. This makeshift evaporator will be found satisfactory for small lots.

The Tunnel Evaporator.—The tunnel evaporator will handle large quantities of materials. These materials are quickly evaporated and as a result possess exceptionally good color and high quality. An efficient evaporator of this type is constructed as follows. A sheet-iron hood, which has a conical top, surrounds a source of heat preferably a wood or coal stove or coil of steam pipe. The hood should come well down over the heated portion of whatever source of heat employed. A large pipe with an elbow leads out from the top of the hood. This pipe should be 20 per cent greater in diameter than the diameter of the fan. The outer end of the pipe leads into the evaporator. The evaporator may be made of boards or it may be a wood frame covered with plaster board or heavy paper. Its size must bear some relation to the size of the fan. If a 12-inch fan is used the tunnel may be $2\frac{1}{2}$ feet wide, 2 feet deep and 12 to 15 feet long. The end at which the pipe enters is closed except for a hole just large enough to admit the pipe. The opposite end is open. An electric fan is placed within the tunnel just in front of the pipe. A door should be placed in the side of the tunnel beginning about 2 feet from the fan. It should be of sufficient length to permit the removal of trays from the evaporator and should extend from top to bottom of the tunnel or box. The trays are made of wood frames with fine-mesh non-rust, wire bottom. The sides of the trays are $\frac{1}{2} \times 2\frac{1}{2}$ inches while the ends are $\frac{1}{2} \times 1$ inch. This type of construction permits the trays being racked one above the other and at the same time allows free circulation of air over materials in the trays. The prepared materials are spread in a thin layer over the trays which are placed into the tunnel through the open end. They are placed one above the other until the stack reaches the top of the tunnel. The whole stack is then pushed into the tunnel far enough to permit the formation of another stack. As soon as trays of materials are placed in the tunnel the heat is turned on and the fan is started. The fan draws the warm air from within the hood and blows it through the tunnel, where it quickly dries the materials. A thermometer should be placed through the side or top of the tunnel about 18 inches from the fan. The temperature should be controlled so as to maintain a temperature in the tunnel of 120° to 140° F. The higher temperature

FIG. 64.—A kitchen type evaporator for fruits and vegetables.

should come during the latter half of the process. It requires only a few hours to thoroughly evaporate properly prepared materials in a well-managed tunnel evaporator.

The Raw Material.—The quality of dried or evaporated products is conditioned quite largely upon the character of the raw materials. Fruits should be ripe but not soft or mellow. Vegetables of the more perishable type such as corn, peas and string beans should be in prime condition for table use. Vegetables that are old or that have become

FIG. 65.—A common type of farm apple evaporator.

stale should not be used. The quality of the material is not improved by the drying process.

Precooking or Blanching.—Practically all vegetables and a few of the fruits should be given a short precooking or blanching before the drying or evaporation process begins. This precooking performs several distinct functions. (1) The vegetable tissue is killed and this prevents certain chemical changes which are likely to take place in uncooked vegetables during the early stages of the evaporation process. (2) The tissues are softened, which accelerates the loss of moisture. (3) The color is generally improved over that of uncooked material. (4) If precooking has been thorough less time is required to prepare the dried product for the table.

The precooking may vary from a short blanching of a few seconds to several minutes of exposure to boiling water. Some products such as corn and string beans may be cooked until done enough to serve.

FRUITS

Apples

Apples are peeled and cored with a cylindical corer. They are then cut into thin slices or disks, $\frac{1}{4}$ inch or less. The slices are cut at right angles to the core. The prepared slices are dropped into a weak brine (1 table-spoonful of salt per quart of water). When the fruit is all prepared it is removed from the brine, rinsed in clear water and placed on the trays. It is then ready to be evaporated or dried.

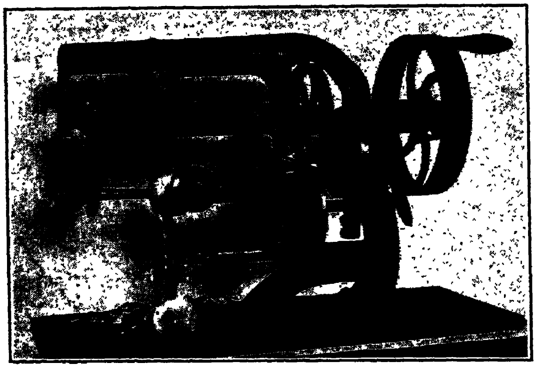

Fig. 66.—A commercial type of apple peeler and corer.

If apples are to be dried in quantity a paring and coring machine will greatly facilitate preparation.

Peaches

The fruit may be peeled or it may be washed and rubbed to remove the excess fuzzy bloom and dried with the skin on. The peeled fruit gives a much more attractive product. If the fruit is quite soft the pulp may be forced through a colander or fine sieve and the pulps dried to form a paste or leather. Freestone peaches are more easily handled since the separation of pulp and pit are easily accomplished. If the fruits are clingstone the pulp or flesh must be cut from the pits. It is customary to dry peaches in halves. The prepared fruits are dropped into a weak brine (1 tablespoonful salt per quart of water) and left there for at least 10 minutes. The fruit is then removed from the brine, rinsed in clear water and spread in an even layer on the trays. If in halves the cups should be up. If pulped the pulp should be spread on oiled tins or on heavy waxed paper.

Pears and Quinces

As a rule these fruits require hand peeling and because of shape and size of core the fruits must be halved before coring. The coring hook (see page 35) is an excellent implement for removing the cores. The halves are, as a rule, too large for drying but they may be successfully

evaporated. If to be dried the halves should be cut into six or eight thin slices. The prepared fruit should stand for at least 10 minutes in a weak brine as recommended for apples and peaches. The rinsed pieces are spread on the trays for drying or evaporating.

Blueberries

This fruit if untreated dries slowly and the result is generally unsatisfactory. If, however, the fruit is given a short blanching (10 to 20 seconds) in boiling water followed immediately by a cooling in cold water it will dry quickly and uniformly. The blanched fruit is spread in a thin layer on trays.

Blackberries and Black Raspberries

These fruits as well as red and purple raspberries are manipulated in the same manner as given under blueberries.

Prunes

Prunes are most always dried whole. They may be halved and pitted and dried in the same manner as described for peaches. Whole prunes are given a short exposure to hot lye solution in order to check or crack the skin in order that the moisture may readily escape. The lye solution is made by dissolving 4 to 6 ounces of concentrated lye in 1 gallon of water. This solution is kept heated to near the boiling point. The prunes may be placed in a wire basket which is lowered into the hot solution and left there for 20 to 30 seconds or until the skin of the fruits is thoroughly checkered with tiny cracks. The fruit is then given a quick cooling and is thoroughly washed to remove all traces of lye. The prepared fruits are spread in a single layer on the trays.

Other firm-fleshed varieties of the European plums may be halved, pitted and dried in the same manner as given under peaches.

VEGETABLES

Beans

String or snap beans should be taken when young. If they become too old the pods are too fibrous for successful evaporation. String beans are much better when evaporated quickly. The long drying process seriously affects both appearance and quality.

The freshly harvested beans are snipped and cut into suitable lengths. They are then blanched in boiling water for 10 to 15 minutes. After

thorough cooling in cold water they are drained and spread in a thin layer on trays.

Corn

Sweet corn should be picked when it is prime for table use. The husks and silks are removed and the ears are blanched in boiling water for 8 to 10 minutes. After thorough cooling in cold water the kernels are cut from the cob, as in canning, and are spread in a thin layer over the drying trays.

Sweet corn is one of the most satisfactory vegetables for drying. It may be prepared and served on the table in the same manner as canned corn.

Peas

Peas should be in good condition for table use. After shelling they are blanched for 5 to 8 minutes in boiling water, cooled in cold water, then spread in thin layers on trays for drying. Peas should not be dried in the sun. They are much more satisfactory if evaporated.

Root Crops

Most of the root crops such as carrots, beets, parsnips and turnips may be evaporated if conditions warrant it.

The roots are washed and scrubbed clean. They may be pared or scraped to remove the skin. They are then cut into slices or small cubes, blanched for 3 to 5 minutes, cooled in cold water and spread on trays ready for drying or evaporating.

Pumpkin and Squash

These two were old-time favorites of a bygone generation. The pumpkin was cut into strips or rings 1 inch in width. The peel and inner fibrous material were removed. The rings were strung on a light pole or the strips were strung on a heavy string and placed in the sunshine to dry. Modern methods have added to this by cutting the slices into pieces of about one-half inch in thickness. These are blanched in steam for 3 to 5 minutes or until quite flexible, cooled in cold water and spread in thin layers on trays. The quality and color are much better if these vegetables are evaporated rather than dried.

Soup Mixtures

Each vegetable used in making the mixture should be prepared and evaporated separately. They may then be mixed in the proportions

desired. Any combination of vegetables may be made. The following is an old and much-used mixture: Cabbage, celery, onions, and carrots.

(*a*) *Cabbage.*—The cabbage is shredded by means of a kraut cutter or sharp knife. It is blanched in steam for 5 to 6 minutes, cooled in cold water and spread thinly on trays.

(*b*) *Celery.*—The outer leaf stalks are generally used. These are cut into ½-inch lengths and blanched in steam for 8 to 10 minutes. It is then spread thinly on the trays and evaporated.

(*c*) *Onions.*—The onions are blanched in hot water for 1 to 2 minutes and cooled in cold water. The skin is stripped off and the onions

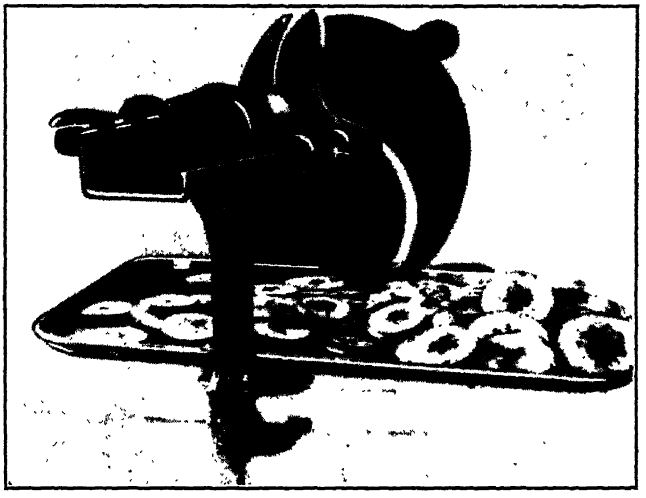

Fig. 67.—Adjustable slicer for fruits and vegetables.

are cut into thin slices. The slices are blanched in steam for 6 to 8 minutes, cooled in cold water and spread on trays. They should be evaporated for best quality.

(*d*) *Parsley.*—Parsley is washed, blanched in steam, cooled and evaporated quickly until quite dry. It is then broken into fine pieces by rubbing between the hands.

(*e*) *Carrots.* See page 87.

Care of Dried Foods

When Products are Dry.—Experience alone can best teach the beginner when the materials are sufficiently dry for storing. The following suggestions may be of help to the beginner. Fruits are dry if a quantity of them can be squeezed tightly in the hand and when the hand is

opened the pieces separate one from the others and assume a fairly normal shape. Berries if not dry will stain the fingers when squeezed in the hand.

Vegetables are dry when no moisture can be squeezed from them when they are pinched between the thumb and finger, or if the soft pulp cannot be pressed out from a cut or broken surface. If an error is made it should be in favor of having the products too dry rather than that they contain too much moisture.

Conditioning.—There are many reasons why all the pieces on a tray will not be uniformly dry. And it will also happen, occasionally, that some products will become too dry. These difficulties may be corrected by the process known as conditioning. The dried products are removed from the trays and placed in a heap where they are allowed to remain for 24 to 48 hours. An occasional stirring or mixing will hasten this process. During this time all the pieces in the heap become uniform in their moisture content. They have, if too dry, absorbed sufficient moisture from the air to make them soft and flexible. When thoroughly conditioned the products should be stored.

Storage.—Three things must be guarded against in storing dried products: They are rodents, insects, and excess moisture. Any storage conditions which gives protection against these will be satisfactory.

A very common practice in rural sections is to pack the product into paper bags, tie the opening securely and tightly and hang the bags in the attic on nails in the rafters or cross beams. Unused glass jars which have tight fitting covers may be used and the jars may be stored on the pantry shelves.

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CHAPTER XXVII

THE HOME OR FARM FACTORY

It has been demonstrated by the experiences of many operators that the small home or farm factory can become a good business. During the past few years a large number of these small home plants have been developed throughout various sections of the country. They vary within wide limits with regard to type and character of products, methods of operation, size of business and system of marketing the finished products.

These small factories perform an important part in the economics of the community. They conserve large quantities of food materials which would otherwise be lost or marketed at a sacrifice; they supply high quality foods with the home-made flavor to those who are willing to pay for them; they give pleasant and profitable employment to many people and they enable the farmer or the homemaker to start a business in a small way, which may be developed into a very profitable enterprise without a large initial expense for equipment. The experiences of factory operators show that, as a general rule, it is better to begin with a small output of products and to increase the equipment and other expenses to meet the needs of a growing business.

Occasionally the home factory is developed into one of commercial size. But most of them maintain the output at such a level that the methods of operation are essentially home methods.

Classification.—The home food factories may be classed, according to their type of activities as special and general.

Special.—In the special factory the effort is restricted to the production of one product or to a group of products derived from the same or similar materials. The fruit grower may manufacture and sell cider or he may diversify to the extent of producing some of the by-products of cider such as vinegar, cider jelly and apple butter. Or he may confine his efforts to the production of apple sauce and its by-product apple jelly. The market gardener may preserve his excess crops or the off type grades of cauliflower, cucumbers, string beans, green tomatoes and sweet pepper in brine and after the growing seasons activities are over these materials are utilized to produce a variety of

pickles and relishes. The Poultryman may specialize in canned chicken and poultry products. Beside these there are the specialists in candies, jellies, maple products, mince meat, etc.

General.—The marked feature of the general factory is the large number of products manufactured. Fruits, vegetables, meats and poultry may all be utilized to produce a large assortment of canned and manufactured foods. This diversification enables the operator to extend the period of active work over a large part of the year. The sales are usually large because of the wide choice of foods from which

FIG. 68.—A farm canning plant and food factory.

the customer may make his selection. The greater number of active home factories are of this type.

Equipment.—The equipment necessary to successfully operate a home factory will be determined by the kind and amount of products manufactured. The location will determine whether gas or some other material shall be the source of heat.

Special Factory.—The operator of the special factory will require equipment suitable to handle the type of products that are to be made. The cider maker must have a good cider mill, abundance of water and facilities for keeping the cider cool. If apple butter is included a butter cooker (see page 243) will be necessary while the manufacture of vinegar will require casks or vats for carrying on the necessary fermentation processes. (See Chapter XXI, Cider and Cider Products.) The vege-

table gardener must have casks or vats in which to ferment his vegetables, food choppers and equipment for cooking. (See Chapter XVIII, Vegetable Pickles and Relishes.) The Poultryman will need canning equipment and an adequate source of heat.

General Factory.—The beginner in the business of general canning and manufacturing will find the greater part of the necessary equipment in the well-ordered home kitchen. This may need to be supplemented with a few cooking vessels and processers together with some time-saving equipment for use in preparing materials. As the business grows and

FIG. 69.—A home food factory.

A. A sun cooker, used for making preserves, attached to the side of the building.

as the operator gains experience he will find many additional pieces of equipment which will be of economic value to the business. As a general rule, the business of the home factory is an increasing one and at the close of the first or second season the operator will be faced with the problem of increasing production to meet the larger demand.

Increased production may be had by adding to the present equipment a number of duplicates and by repeating operations of cooking and processing, or the present equipment may be discarded and replaced by a type designed to handle materials in large quantities. Both plans have their advantages and disadvantages. The operator of the home factory must not forget that the two most important factors in the production of foods with the characteristic home-made flavor are

freshness and quality of raw materials and the methods of handling them in the factory.

If the increased production of manufactured fruit products is to be made through duplication of equipment and operations, the raw materials are cooked in relatively small lots, the individual batches of finished products are small, the cooking period will be short and the methods are essentially home methods. Fruit products of superior quality are made in this manner. (See Chapter X, Fruit Products.) The canning of fruits and vegetables presents a rather complicated set

FIG. 70.—A group of steam-jacketed kettles used in a farm food factory.

of problems. The limiting factor in canning a large volume of products may be the labor necessary to prepare and pack the materials or it may be the capacity of the processers. These two operations should be so coordinated that there is no long period of waiting between the time of packing the containers and processing them.

The maximum capacity of a water bath processer or pressure cooker which may be successfully operated over a gas or kerosene flame is less than 2 dozen pint jars. Two or more processers of moderate capacity are more desirable for home canning than a single large processer. The use of small or moderate size processers means duplication of equipment but the advantages to the small canner will justify it.

The operator of a large home factory may prefer to install a small

boiler (10 to 15 horsepower) from which steam under pressure may be taken for heating the processers, blanching water and for general use in cooking. All processing and cooking operations are shortened by use of pressure steam. If the water bath processer is used the water may be brought quickly to boiling by means of pressure steam flowing through a coil in the bottom of the processer. Steam-jacketed kettles and steam coils may be used for all cooking operations. The installation of equipment for use of steam is expensive but where production is large the saving in time and effort will justify it.

FIG. 71.—A back porch used as a preparation room in a home factory.

Marketing the Products.—The method to be used in marketing the products made in the home factory is an individual problem. As a general rule the sales are direct to the consumer. This method eliminates the middle man's profits and brings the manufacturer and consumer into close relationship. Some operators sell at the factory or from a roadside stand or through a tea room which is operated in connection with the factory. Some make personal calls upon old and prospective customers, others write a personal letter describing their products. This together with a price list and order blank is mailed to previous customers and to a selected few who may be considered as prospective customers.

Exhibits of canned and manufactured foods at fairs and exhibitions accompanied with some judicious advertising matter are great aids in

securing a clientele. Also an exhibit of all foods made in the factory should be maintained at the plant. Customers and others should be invited to visit the factory to see just how it is managed and operated. Visitors are always interested in exhibits of attractive foods. This interest will lead to many trial orders. Every satisfied customer of the home factory becomes a valuable asset to the business. It is often through their influence that a large part of the new business is secured.

The occasional factory will find its market through the specialty shops or high class stores. This system will dispose of a large volume

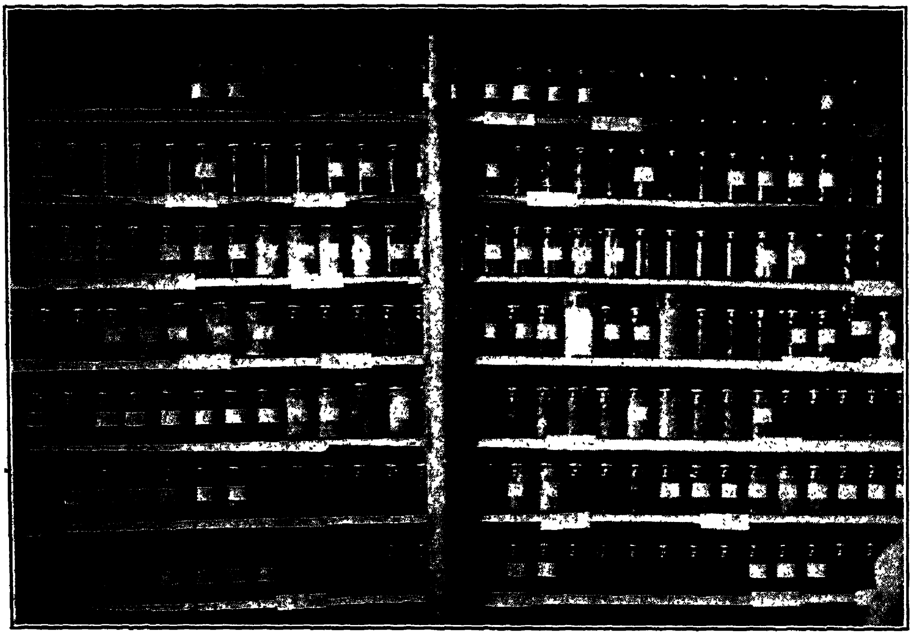

FIG. 72.—Exhibit of canned foods in a home factory.

of products with a minimum expenditure of time and effort but at a less profit than if sold directly to the consumer. Those who use this method do not have the close association with the consumer as do those who deal directly.

The Factory.—The size of the factory will be determined by the kind and amount of work that is to be done. The home kitchen, if not too small, is suitable for a small output of products. There are now many factories operated in the home kitchen which do an annual business of a thousand dollars or more. A screened-in porch may be used as an extension to the home kitchen or an addition may be built to the kitchen. Larger enterprises are generally conducted in a build-

ing separate from the home. Regardless of size, type or location the factory must always be kept clean and absolutely sanitary. Those who handle foods cannot afford to have their premises in such condition as to become a menace to the health of their customers.

Sources of Heat.—The source of heat constitutes one of the important problems in the establishments of a home factory. The common sources, arranged in the order of their desirability and efficiency are coal or wood, kerosene, gas and steam. Oil burners which may be installed in the kitchen range to take the place of coal or wood are now

FIG. 73.—Visitors' reception room and sales room in a farm canning plant.

available and are used by a few operators. If available gas is the most satisfactory fuel for small and medium size factories. It may be more expensive than kerosene but it gives a more intense heat and therefore shortens practically all cooking operations. Steam as has been stated is the best heat source for the larger factory. The expense of installation and upkeep are much greater than for any other type of heat but the operating costs are less. The ease of control and the speed of all operations compensate for the added cost.

Containers.—A supply of containers of size and style and in quantity needed is a problem which the factory operator must solve for himself. Manufacturers of glassware will not, as a rule, care for the business of a small factory. The local retailer is also unable to supply containers

other than those commonly used in general home canning and preserving and these are often of a type not desired for commercial work.

FIG. 74.—Interior of a farm canning plant. Steam is used for all cooking.

FIG. 75.—A corner in a home canning plant. Kerosene is the only fuel used.

If there are a number of small factories in the same locality they can, by cooperation, secure better rates and prompt attention from the smaller manufacturers and wholesale dealers. The small operator

should consult with a number of jobbers in nearby cities. When he has located the kind of containers best suited to the proposed work arrangements can be made with the jobber for future supplies.

The containers should be of clear glass and of the best quality. The use of a large number of sizes and styles should be avoided. Usually pint and half-pint jars for canning, quarter pints and half-pint jars for manufactured fruit and vegetable product and two-, four- and six-ounce screw cap glasses for jellies will give a sufficient range. A supply of two-quart or four-quart jars are very useful for storing partially manufactured foods, fruit juices, jelly stock, etc. All products except jellies should be packed in containers which can be hermetically sealed. This practice is the best insurance against loss through spoilage. Jellies should be paraffined as a protection against molds.

FIG. 76.—An unlimited market for good wholesome home manufactured food products.

Labels.—All foods offered for sale must be properly labeled. (See Appendix B.) The label should be neat, attractive and not too large. It should carry the name of the product, the amount in the package and the name and address of the manufacturer. If any adulterant has been added to the food this fact must be stated on the label. As a general rule the label should not contain brilliant colors. Neatness in lettering and design are depended upon for attractiveness. The local printer is the best source for obtaining labels of this character.

Guarantee.—The home factory must stand back of every package of goods sold. If the customer reports spoiled packages the manufacturer must make a satisfactory adjustment by replacement or by making allowance on the customer's bill.

Returned Containers.—Some factory operators sell the contents only of the container and expect the customer (if local) to save the container which later is returned to the factory. Others sell the package complete but with the understanding that the customer may return the empty container and receive credit for them on his next order. Others will not accept returned containers. These operators prefer to use only new containers and will make no allowance for used jars.

There is much that might be said as to the advantages and disadvantages of these three practices. The beginner should give this problem a thorough study in order to determine what practice is best adapted to his particular set of conditions.

APPENDIX A

TABLE SHOWING COMPARATIVE READING OF BAUMÉ AND BALING HYDROMETERS IN SUGAR SYRUP

Baumé Reading	Brix or Baling Reading	Per cent Sugar	Baumé Reading	Brix or Baling Reading	Per cent Sugar
0	0	0	21.91	40	40
2.8	5	5	24.56	45	45
5.56	10	10	27.19	50	50
8.30	15	15	29.77	55	55
11.07	20	20	32.36	60	60
13.80	25	25	34.88	65	65
16.50	30	30	37.40	70	70
19.20	35	35			

CONVERSION FACTORS

Grains to grams multiply by.................... 0.065
Ounces, av., to grams multiply by............... 28.35
Pounds to grams multiply by.................. 453.6
Grams to grain multiply by.................... 15.4
Grams to ounces, av., multiply by............... .35
Liter to pints multiply by...................... 1.76
Inches to centimeters multiply by............... 2.54
Centimeters to inches multiply by............... 0.4

HOUSEHOLD MEASURES AND WEIGHTS

1 teaspoonful = 1 fluid dram
1 tablespoonful = 3 teaspoonfuls
2 tablespoonfuls = 1 fluid ounce
1 pint sugar = 1 pound (approximately)
1 pint water = 1 pound (approximately)
1 gallon water = 8.3 pounds
1 gallon water = 231 cubic inches
1 cup = 2 gills
1 pint = 2 cups

MEASURE AND WEIGHT EQUIVALENTS

Material	Weight of 1 Level Tablespoonful		Approximate Tablespoonfuls in 1 Ounce
	Grams	Ounce	
Alum, broken crystals	15.0	.54	1.9
Alum, powdered	8.5	.30	3.3
Allspice, whole	7.5	.27	3.7
Allspice, ground	6.0	.2	5.0
Anise seed	6.0	.2	5.0
Baking soda	11.5	.41	2.5
Benzoate of soda	4.5	.15	6.6
Calcium carbonate powdered	10.0	.35	3.0
Cayenne pepper	7.0	.25	4.0
Caraway seed	7.5	.27	3.7
Coriander seed	4.5	.15	6.6
Celery seed	6.5	.22	4.5
Cinnamon, broken	9.0	.32	3.0
Cinnamon, ground	8.0	.28	3.6
Cloves, whole	6.5	.22	4.5
Cloves, broken	7.0	.25	4.0
Cloves, ground	7.5	.27	3.7
Citric acid	14.0	.52	2.0
Dill seeds	7.5	.27	3.7
Epsom salts	8.5	.33	3.0
Ginger, ground	5.5	.19	5.0
Mustard seed	10.5	.37	2.7
Mustard, ground	7.0	.25	4.0
Mixed spices, whole	7.0	.25	4.0
Mace, ground	6.0	.2	5.0
Nutmeg, ground	7.0	.25	4.0
Paprika	7.0	.25	4.0
Pepper, black, whole	8.0	.28	3.6
Pepper, black, ground	6.5	.22	4.5
Pimento, ground	6.0	.2	5.0
Salicylic acid	3.0	.11	9.0
Salt, dairy	10.5	.37	2.7
Salt, coarse fine	12.5	.44	2.2
Sugar, granulated	11.5	.4	2.5
Tartaric acid broken crystals	14.5	.51	2.0
Turmeric	7.0	.25	4.0

To solve for factor of acetic acid:

$$NaOH + HC_2H_3O_2 =$$

$$23 + 16 + 1 = 1 + 24 + 3 + 32$$

$$40 = 60$$

Then 40 gm. NaOH neutralize 60 gm. $HC_2H_3O_2$

Also 1 l. $\frac{\text{NaOH}}{\text{N}}$ neutralize 60 gm. $HC_2H_3O_2$

1 l. $\frac{\text{NaOH}}{10}$ neutralize 6 gm. $HC_2H_3O_2$

1 cc. $\frac{\text{NaOH}}{10}$ neutralize .006 gm. $HC_2H_3O_2$

cc. of alkali $\times$ .006 = gm. $HC_2H_3O_2$ present.

$$\frac{\text{cc. of alkali} \times .006}{\text{cc. of vinegar}} = \text{gm. } HC_2H_3O_2 \text{ per cc. vinegar.}$$

$$\frac{\text{cc. of alkali} \times .006}{\text{cc. of vinegar}} \times 100 = \%\text{ acetic acid.}$$

Factors of other acids:

Citric	.0064	Tartaric	.0075
Malic	.0067	Lactic	.009
Hydrochloric	.0036	Oleic	.0282

Formulae for a few common acids:

Acetic, $HC_2H_3O_2$

Malic, $H_2C_4N_4O_5$

Citric, $H_3C_6H_5O_7$

Tartaric, $H_2C_4H_4O_6$. This occurs in grapes as $HC_4H_4O_6K$, acid potassium salt, difficultly soluble in water and known as cream of tartar.

In its crude state, e.g., precipitate from grape products, it is called argol.

APPENDIX B

United States Department of Agriculture

FOOD, DRUG, AND INSECTICIDE ADMINISTRATION

SERVICE AND REGULATORY ANNOUNCEMENTS

Food and Drug No. 2*

DEFINITIONS AND STANDARDS FOR FOOD PRODUCTS

(Superseding Office of the Secretary Circulars 13, 17, 19, and 136)

INTRODUCTION

The following definitions and standards for food products have been adopted as a guide for the officials of this department in enforcing the food and drugs act. These definitions and standards include those published in the form of food inspection decisions and those in Circular 136 which have not been superseded by such decisions.

W. M. JARDINE,
Secretary of Agriculture.

WASHINGTON, D. C., *September 19, 1927.*

EXTRACTS FROM ABOVE CIRCULAR

II. VEGETABLE PRODUCTS

A. GRAIN PRODUCTS

a. GRAINS AND MEALS

1. Grain is the fully matured, clean, sound, air-dry seed of wheat, maize, rice, oats, rye, buckwheat, barley, sorghum, millet, or spelt.

2. Rice is the hulled, or hulled and polished, grain of *Oryza sativa* L.

(*a*) Brown rice is the hulled, unpolished grain.

(*b*) Polished rice, "rice," is the hulled grain from which the bran or pericarp has been removed by scouring and rubbing.

* S. R. A., F. D. No. 2; Issued December, 1927.

3. Meal is the clean, sound product made by grinding grain.

4. Graham flour is unbolted wheat meal.

5. Maize meal, corn meal, Indian corn meal, is meal made from sound maize grain, and contains not more than 14 per cent of moisture, not less than 1.12 per cent of nitrogen, and not more than 1.6 per cent of ash.

6. Oatmeal is meal made from hulled oats, and contains not more than 12 per cent of moisture, not more than 1.5 per cent of crude fiber, not less than 2.24 per cent of nitrogen, and not more than 2.2 per cent of ash.

7. Flour is the fine, clean, sound product made by bolting wheat meal. It contains not more than 15 per cent of moisture,[1] not less than 1.25 per cent of nitrogen, not more than 1 per cent of ash, and not more than 0.5 per cent of fiber.

8. Gluten flour is the clean, sound product made from wheat flour by the removal of a large part of the starch, and contains not more than 10 per cent of moisture, and, calculated on the water-free basis, not less than 7.1 per cent of nitrogen, not more than 56 per cent of nitrogen-free extract (using the protein factor 5.7), and not more than 44 per cent of starch (as determined by the diastase method).

9. Ground gluten is the clean, sound product made from wheat flour by the almost complete removal of starch, and contains not more than 10 per cent of moisture, and, calculated on the water-free basis, not less than 14.2 per cent of nitrogen, not more than 15 per cent of nitrogen-free extract (using the protein factor 5.7), and not more than 5.5 per cent of starch (as determined by the diastase method).

10. Buckwheat flour is bolted buckwheat meal, and contains not more than 12 per cent of moisture, not less than 1.28 per cent of nitrogen, and not more than 1.75 per cent of ash.

11. Rye flour is the fine, clean, sound product made by bolting rye meal, and contains not more than 13.5 per cent of moisture, not less than 1.36 per cent of nitrogen, and not more than 1.25 per cent of ash.

b. Breads

1. Bread is the sound product made by baking a dough consisting of a leavened or unleavened mixture of ground grain and/or other clean, sound, edible farinaceous substance, with potable water, and with or without the addition of other edible substances. In the United States the name "bread," unqualified, is understood to mean wheat bread, white bread.

2. Wheat bread dough, white bread dough, is the dough consisting of a leavened and kneaded mixture of flour, potable water, edible fat or oil, sugar and/or other fermentable carbohydrate substance, salt, and yeast, with or without the addition of milk or a milk product, of diastatic and/or proteolytic ferments, and of such limited amounts of unobjectionable salts as serve solely as yeast nutrients,[2] and with or without the replacement of not more than 3 per cent of the flour ingredient by some other edible farinaceous substance.

3. Wheat bread, white bread, is the bread obtained by baking wheat bread dough in the form of a loaf, or of rolls or other units smaller than a loaf. It contains,

[1] By "moisture" is meant the loss in weight resulting from drying in accordance with the vacuum method of the Association of Official Agricultural Chemists. The moisture limit of 15 per cent, thus determined, is regarded as equivalent to the former moisture limit of 13.5 per cent, as determined by the water-oven method.

[2] The propriety of the use of minute quantities of oxidizing agents as enzyme activators is reserved for future consideration and without prejudice.

one hour or more after baking, not more than 38 per cent of moisture, as determined upon the entire loaf or other unit.

4. Milk bread is the bread obtained by baking a wheat bread dough in which not less than one-third of the water ingredient has been replaced by milk or the constituents of milk solids in proportions normal for whole milk. It conforms to the moisture limitation for wheat bread.

5. Rye bread is the bread obtained by baking a dough which differs from wheat bread dough in that not less than one-third of the flour ingredient has been replaced by rye flour. It conforms to the moisture limitation for wheat bread.

6. Raisin bread is the bread obtained by baking wheat bread dough, to which have been added sound raisins in quantity equivalent to at least 3 ounces for each pound of the baked product and which may contain proportions of sweetening and shortening ingredients greater than those commonly used in wheat bread dough.

7. Brown bread, Boston brown bread, is a bread made from rye and corn meals, with or without flour, whole-wheat flour, and/or rye flour, with molasses, and in which chemical leavening agents, with or without sour milk, are commonly used instead of yeast. In some localities the name "brown bread" is used to designate a bread obtained by baking a dough which differs from wheat bread dough in that a portion of the flour ingredient has been replaced by whole-wheat flour.

c. Alimentary Pastes

1. Alimentary pastes are the shaped and dried doughs prepared from semolina, from farina, from wheat flour, or from a mixture of any two or of all of these, with or without salt, and with one or more of the following: Water, egg, egg yolk, milk, a milk product. An alimentary paste contains not more than 13 per cent of moisture, as determined by the vacuum method.

2. Plain alimentary pastes are alimentary pastes made without egg or egg yolk, or so made that the content of the solids of egg and/or of egg yolk is, upon a moisture-free basis, less than 5.5 per cent by weight.

3. Egg alimentary pastes are alimentary pastes which contain, upon a moisture free basis, not less than 5.5 per cent by weight of the solids of egg and/or of egg yolk.

4. Noodles, egg noodles, are a form of egg alimentary paste which, in the course of its preparation, has been rolled or pressed into sheets or ribbons, with or without subsequent cutting or shaping.

5. Water noodles are a form of plain alimentary paste which, in the course of its preparation, has been rolled or pressed into sheets or ribbons, with or without subsequent cutting or shaping.

6. Macaroni, spaghetti, vermicelli, are plain alimentary pastes, distinguished by their characteristic shapes.

7. Semolina macaroni, semolina spaghetti, semolina vermicelli, are plain alimentary pastes in the preparation of which semolina is the only farinaceous ingredient used, and are distinguished by their characteristic shapes.

B. FRUIT AND VEGETABLES

a. Fruit and Fruit Products

(Except fruit juices, fresh, sweet, and fermented, and vinegars)

1. Fruit is the clean, sound, edible, fleshy fructification of a plant and is characterized by its sweet, acid, and/or ethereal flavor.

2. Fresh fruit is fruit which has undergone no material change other than ripening since the time of gathering.

3. Citrus fruits:

(*a*) Grapefruit, pomelo, is the sound, mature fruit of *Citrus grandis* Osbeck. The juice of the mature fruit contains not less than 7 parts of soluble solids to each part of acid calculated as citric acid without water of crystallization.

(*b*) Orange (common, sweet, or round) is the sound, mature fruit of *C. sinensis* Osbeck. The juice of the mature fruit contains not less than 8 parts of soluble solids to each part of acid calculated as citric acid without water of crystallization.

4. Dried fruit is the clean, sound product resulting from the evaporation of the greater portion of the water from properly prepared fresh fruit.

(*a*) The term "sundried" is commonly used to designate the product dried without the use of artificial heat.

(*b*) The terms "evaporated" and "dehydrated" are commonly used to designate the product dried by the use of artificial heat.

5. Evaporated apples are evaporated fruit made from peeled, cored, and sliced apples, and contain not more than 24 per cent of moisture, as determined by the official method of the Association of Official Agricultural Chemists.

6. Cold-pack fruit is the clean, sound product obtained by packing, in a suitable container, properly prepared fresh fruit, with or without the addition of sugar (sucrose), and maintaining it at a temperature sufficiently low to insure its preservation.

7. Canned fruit is the clean, sound product made from properly prepared fresh fruit, with or without water and/or sugar (sucrose),

(*a*) By processing in a suitable, hermetically sealed container, or

(*b*) By heating and packing in a suitable container which is then hermetically sealed.

8. Preserve, fruit preserve, jam, fruit jam, is the clean, sound product made by cooking to a suitable consistence properly prepared fresh fruit, cold-pack fruit, canned fruit, or a mixture of two or of all of these, with sugar (sucrose) or with sugar and water. In its preparation not less than 45 pounds of fruit are used to each 55 pounds of sugar (sucrose). A product in which the fruit is whole or in relatively large pieces is customarily designated a "preserve" rather than a "jam."

9. Glucose fruit preserve, corn sirup fruit preserve, glucose fruit jam, corn sirup fruit jam, is the clean, sound product made by cooking to a suitable consistence properly prepared fresh fruit, cold-pack fruit, canned fruit, or a mixture of two or of all of these, with glucose or corn sirup. In its preparation not less than 45 pounds of fruit are used to each 55 pounds of glucose or corn sirup.

10. Fruit butter is the sound product made from fruit juice and clean, sound, properly matured and prepared fruit, evaporated to a semisolid mass of homogeneous consistence, with or without the addition of sugar and spices or vinegar, and conforms in name to the fruit used in its preparation.

11. Glucose fruit butter, corn sirup fruit butter, is a fruit butter in which glucose, or corn sirup, is used in place of sugar (sucrose).

12. Jelly, fruit jelly, is the clean, sound, semisolid, gelatinous product made by concentrating to a suitable consistence the strained juice, or the strained water extract, from fresh fruit, from cold-pack fruit, from canned fruit, or from a mixture of two or of all of these, with sugar (sucrose).

13. Glucose fruit jelly, corn sirup fruit jelly, is the clean, sound, semisolid, gelat-

inous product made by concentrating to a suitable consistence the strained juice, or the strained water extract, from fresh fruit, from cold-pack fruit, from canned fruit, or from a mixture of two or of all of these, with glucose or corn sirup.

14. Citrus fruit marmalade is the clean, sound, jelly-like product made from the properly prepared juice and peel, with or without the pulp, of fresh citrus fruit, of canned citrus fruit, or of a mixture of these, by cooking with water and sugar (sucrose). It contains, embedded in the mass, pieces of the fruit peel, with or without portions of the pulp of the fruit.

b. Nut and Fruit Kernel Products

1. Almond paste is the plastic product obtained by cooking blanched and ground sweet almonds with blanched and ground bitter almonds, sugar, and water. It contains not more than 14 per cent of water nor more than 40 per cent of total sugars expressed as invert sugar.

2. Kernel pastes are the plastic products obtained by cooking, with sugar and water, the blanched and ground kernels of one or more of the following: Apricots, peaches, plums (prunes). They are free from hydrocyanic acid and contain not more than 14 per cent of water, nor more than 40 per cent of total sugars expressed as invert sugar. A kernel paste conforms in name to the kind or kinds of kernels employed in its production.

c. Vegetables and Vegetable Products

1. Vegetables are the succulent, clean, sound, edible parts of herbaceous plants used for culinary purposes.

2. Dried vegetables are the clean, sound products made by drying properly matured and prepared vegetables in such a way as to take up no harmful substance, and conform in name to the vegetables used in their preparation; sundried vegetables are dried vegetables made by drying without the use of artificial means; evaporated vegetables are dried vegetables made by drying with the use of artificial means.

3. Canned vegetables are properly matured and prepared fresh vegetables, with or without the addition of potable water, salt, and sugar, as specified in the separate definitions for the several kinds of canned vegetables, sterilized by heat, with or without previous cooking, in vessels from which they take up no injurious substance, and kept in suitable, clean, hermetically sealed containers.

4. Canned peas are the canned vegetables prepared from the well developed but still tender seeds of the common or garden pea (*Pisum sativum*) by shelling, winnowing, and thorough washing, with or without grading and with or without precooking (blanching), and by the addition, before sterilization, of the necessary amount of potable water, with or without sugar and salt.

Canned pea varieties:

Early peas are peas of early maturing sorts having a smooth skin.

Sugar peas, sweet peas, are peas of later maturing varieties having a wrinkled skin and sweet flavor.

Canned pea sizes:

No. 1 peas are peas which were, before precooking (blanching), small enough to pass through a screen of 9/32-inch (7 mm.) mesh.

No. 2 peas are peas which were, before precooking (blanching), small enough to pass through a screen of 10/32-inch (8 mm.) mesh.

No. 3 peas are peas which were, before precooking (blanching), small enough to pass through a screen of 11/32-inch (8.7 mm.) mesh.

No. 4 peas are peas which were, before precooking (blanching), small enough to pass through a screen of 12/32-inch (9.5 mm.) mesh.

No. 5 peas are peas which were, before precooking (blanching), small enough to pass through a screen of 13/32-inch (10.3 mm.) mesh.

No. 6 peas are peas not all of which were, before precooking (blanching), small enough to pass through a screen of 13/32-inch (10.3 mm.) mesh.

5. Pickles are clean, sound, immature cucumbers, properly prepared, without taking up any metallic compound other than salt, and preserved in any kind of vinegar, with or without spices; pickled onions, pickled beets, pickled beans, and other pickled vegetables are vegetables prepared as described above, and conform in name to the vegetables used.

6. Salt pickles are clean, sound, immature cucumbers, preserved in a solution of common salt, with or without spices.

7. Sweet pickles are pickled cucumbers or other vegetables in the preparation of which sugar (sucrose) is used.

8. Sauerkraut is the clean, sound product, of characteristic acid flavor, obtained by the full fermentation, chiefly lactic, of properly prepared and shredded cabbage in the presence of not less than 2 per cent nor more than 3 per cent of salt. It contains, upon completion of the fermentation, not less than 1.5 per cent of acid, expressed as lactic acid. Sauerkraut which has been rebrined in the process of canning or repacking contains not less than 1 per cent of acid, expressed as lactic acid.

9. Catchup (ketchup, catsup) is the clean, sound product made from the properly prepared pulp of clean, sound, fresh, ripe tomatoes, with spices and with or without sugar and vinegar; mushroom catchup, walnut catchup, etc., are catchups made as above described, and conform in name to the substances used in their preparation.

C. SUGARS AND RELATED SUBSTANCES

a. Sugar and Sugar Products

SUGARS

1. Sugar is the product chemically known as sucrose (saccharose), chiefly obtained from sugar cane, sugar beets, sorghum, maple, and palm.

2. Granulated, loaf, cut, milled, and powdered sugars are different forms of sugar, and contain at least 99.5 per cent of sucrose.

3. Maple sugar, maple concrete, is the solid product resulting from the evaporation of maple sap or maple sirup.

4. Massecuite, melada, mush sugar, and concrete are products made by evaporating the purified juice of a sugar-producing plant, or a solution of sugar, to a solid or semisolid consistence, and in which the sugar chiefly exists in a crystalline state.

MOLASSES AND REFINERS' SIRUP

5. Molasses is the product left after separating the sugar from massecuite, melada, mush sugar, or concrete, and contains not more than 25 per cent of water and not more than 5 per cent of ash.

6. Refiners' sirup, treacle, is the residual liquid product obtained in the process

of refining raw sugars, and contains not more than 25 per cent of water and not more than 8 per cent of ash.

SIRUPS

7. Sirup is the sound product made by purifying and evaporating the juice of a sugar-producing plant without removing any of the sugar.

8. Sugar-cane sirup is sirup made by the evaporation of the juice of the sugar-cane or by the solution of sugar-cane concrete, and contains not more than 30 per cent of water and not more than 2.5 per cent of ash.

9. Sorghum sirup is sirup made by the evaporation of sorghum juice or by the solution of sorghum concrete, and contains not more than 30 per cent of water and not more than 2.5 per cent of ash.

10. Maple sirup is sirup made by the evaporation of maple sap or by the solution of maple concrete, and contains not more than 35 per cent of water, and weighs not less than 11 pounds to the gallon (231 cubic inches).

11. Sugar sirup is the product made by dissolving sugar to the consistence of a sirup, and contains not more than 35 per cent of water.

b. Glucose Products

1. Starch sugar is the solid product made by hydrolyzing starch or a starch-containing substance until the greater part of the starch is converted into dextrose. Starch sugar appears in commerce in two forms, anhydrous starch sugar and hydrous starch sugar. The former, crystallized without water of crystallization, contains not less than 95 per cent of dextrose and not more than 0.8 per cent of ash. The latter, crystallized with water of crystallization, is of two varieties: 70 sugar, also known as brewers' sugar, contains not less than 70 per cent of dextrose and not more than 0.8 per cent of ash; 80 sugar, climax or acme sugar, contains not less than 80 per cent of dextrose and not more than 1.5 per cent of ash. The ash of all these products consists almost entirely of chlorides and sulphates.

2. Glucose, mixing glucose, confectioner's glucose, is a thick, sirupy, colorless product made by incompletely hydrolyzing starch, or a starch-containing substance, and decolorizing and evaporating the product. It contains on a basis of 41° Baumé not more than 1 per cent of ash, consisting chiefly of chlorides and sulphates.

c. Candy

1. Candy is a product made from a saccharine substance or substances, with or without the addition of harmless coloring, flavoring, or filling materials, and contains no terra alba, barytes, talc, chrome yellow, or other mineral substances, or poisonous colors or flavors, or other ingredients deleterious or detrimental to health, or any vinous, malt, or spirituous liquor or compound, or narcotic drug.

d. Honey

1. Honey is the nectar and saccharine exudations of plants gathered, modified, and stored in the comb by honey bees (*Aphis mellifica* and *A. dorsata*), is lævorotatory, and contains not more than 25 per cent of water, not more than 0.25 per cent of ash, and not more than 8 per cent of sucrose.

2. Comb honey is honey contained in the cells of comb.

3. Extracted honey is honey which has been separated from the uncrushed comb by centrifugal force or gravity.

4. Strained honey is honey removed from the crushed comb by straining or other means.

D. CONDIMENTS (OTHER THAN WINES, VINEGARS, AND SALT)

a. Spices

The term "dried" as used in this schedule refers to the air-dried product. The term "starch" as used in this schedule refers to starch as determined by the official diastase method. In the examination of the products listed in this schedule the methods of analysis of the Association of Official Agricultural Chemists should be followed, except where otherwise specified.

1. Spices are aromatic vegetable substances used for the seasoning of food. They are clean, sound, and true to name, and from them no portion of any volatile oil or other flavoring principle has been removed.

2. Allspice, pimento, is the dried, nearly ripe fruit of *Pimenta officinalis* Lindl. It contains not less than 8 per cent of quercitannic acid (calculated from the total oxygen absorbed by the aqueous extract), not more than 25 per cent of crude fiber, not more than 6 per cent of total ash, nor more than 0.4 per cent of ash insoluble in hydrochloric acid.

3. Anise, aniseed, is the dried fruit of *Pimpinella anisum* L. It contains not more than 9 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

4. Bay leaves are the dried leaves of *Laurus nobilis* L.

5. Capers are the flower buds of *Capparis spinosa* L.

6. Caraway, caraway seed, is the dried fruit of *Carum carvi* L. It contains not more than 8 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

7. Cardamom is the dried, nearly ripe fruit of *Elettaria cardamomum* Maton.

8. Cardamom seed is the dried seed of cardamom. It contains not more than 8 per cent of total ash, nor more than 3 per cent of ash insoluble in hydrochloric acid.

9. Red pepper is the red, dried, ripe fruit of any species of Capsicum. It contains not more than 8 per cent of total ash, nor more than 1 per cent of ash insoluble in hydrochloric acid.

10. Cayenne pepper, Cayenne, is the dried, ripe fruit of *Capsicum frutescens* L., *C. baccatum* L., or some other small-fruited species of Capsicum. It contains not less than 15 per cent of nonvolatile ether extract, not more than 1.5 per cent of starch, not more than 28 per cent of crude fiber, not more than 8 per cent of total ash, nor more than 1.25 per cent of ash insoluble in hydrochloric acid.

11. Paprika is the dried, ripe fruit of *Capsicum annuum* L. It contains not more than 8.5 per cent of total ash, nor more than 1 per cent of ash insoluble in hydrochloric acid. The iodine number of its extracted oil is not less than 125, nor more than 136.

12. Hungarian paprika is paprika having the pungency and flavor characteristic of that grown in Hungary.

(*a*) Rosenpaprika, rosapaprika, rose paprika, is Hungarian paprika prepared by grinding specially selected pods of paprika, from which the placentæ, stalks, and stems have been removed. It contains no more seeds than the normal pods, not more than 18 per cent of nonvolatile ether extract, not more than 23 per cent of crude fiber, not more than 6 per cent of total ash, nor more than 0.4 per cent of ash insoluble in hydrochloric acid.

(b) Koenigspaprika, king's paprika, is Hungarian paprika prepared by grinding whole pods of paprika without selection, and includes the seeds and stems naturally occurring with the pods. It contains not more than 18 per cent of nonvolatile ether extract, not more than 23 per cent of crude fiber, not more than 6.5 per cent of total ash, nor more than 0.5 per cent of ash insoluble in hydrochloric acid.

13. Pimenton, pimiento, Spanish paprika, is paprika having the characteristics of that grown in Spain. It contains not more than 18 per cent of nonvolatile ether extract, not more than 21 per cent of crude fiber, not more than 8.5 per cent of total ash, nor more than 1 per cent of ash insoluble in hydrochloric acid.

14. Celery seed is the dried fruit of *Celeri graveolens* (L.) Britton (*Apium graveolens* L.). It contains not more than 10 per cent of total ash, nor more than 2 per cent of ash insoluble in hydrochloric acid.

15. Cinnamon is the dried bark of cultivated varieties of *Cinnamomum zeylanicum* Nees or of *C. cassia* (L.) Blume, from which the outer layers may or may not have been removed.

16. Ceylon cinnamon is the dried inner bark of cultivated varieties of *Cinnamomum zeylanicum* Nees.

17. Saigon cinnamon, cassia, is the dried bark of cultivated varieties of *Cinnamomum cassia* (L.) Blume.

18. Ground cinnamon, ground cassia, is the powder made from cinnamon. It contains not more than 5 per cent of total ash, nor more than 2 per cent of ash insoluble in hydrochloric acid.

19. Cloves are the dried flower buds of *Caryophyllus aromaticus* L. They contain not more than 5 per cent of clove stems, not less than 15 per cent of volatile ether extract, not less than 12 per cent of quercitannic acid (calculated from the total oxygen absorbed by the aqueous extract), not more than 10 per cent of crude fiber, not more than 7 per cent of total ash, nor more than 0.5 per cent of ash insoluble in hydrochloric acid.

20. Coriander seed is the dried fruit of *Coriandrum sativum* L. It contains not more than 7 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

21. Cumin seed is the dried fruit of *Cuminum cyminum* L. It contains not more than 9.5 per cent of total ash, not more than 1.5 per cent of ash insoluble in hydrochloric acid, nor more than 5 per cent of harmless foreign matter.

22. Curcuma, turmeric, is the dried rhizome or bulbous root of *Curcuma longa* L.

23. Dill seed is the dried fruit of *Anethum graveolens* L. It contains not more than 10 per cent of total ash, nor more than 3 per cent of ash insoluble in hydrochloric acid.

24. Fennel seed is the dried fruit of cultivated varieties of *Foeniculum vulgare* Hill. It contains not more than 9 per cent of total ash, nor more than 2 per cent of ash insoluble in hydrochloric acid.

25. Ginger is the washed and dried, or decorticated and dried, rhizome of *Zingiber officinale* Roscoe. It contains not less than 42 per cent of starch, not more than 8 per cent of crude fiber, not more than 1 per cent of lime (CaO), not less than 12 per cent of cold-water extract, not more than 7 per cent of total ash, not more than 2 per cent of ash insoluble in hydrochloric acid, nor less than 2 per cent of ash soluble in cold water.

26. Jamaica ginger is ginger grown in Jamaica. It contains not less than 15

per cent of cold-water extract, and conforms in other respects to the standards for ginger.

27. Limed ginger, bleached ginger, is whole ginger coated with carbonate of calcium. It contains not more than 4 per cent of carbonate of calcium, nor more than 10 per cent of total ash, and conforms in other respects to the standards for ginger.

28. Horse-radish is the root of *Radicula armoracia* (L.) Robinson.

29. Prepared horse-radish is comminuted horse-radish, with or without a vinegar.

30. Mace is the dried arillus of *Myristica fragrans* Houtt. It contains not less than 20 per cent nor more than 30 per cent of nonvolatile ether extract, not more than 10 per cent of crude fiber, not more than 3 per cent of total ash, nor more than 0.5 per cent of ash insoluble in hydrochloric acid.

31. Macassar mace, Papua mace, is the dried arillus of *Myristica argentea* Warb.

32. Marjoram, leaf marjoram, is the dried leaves, with or without a small proportion of the flowering tops, of *Majorana hortensis* Moench. It contains not more than 16 per cent of total ash, not more than 4.5 per cent of ash insoluble in hydrochloric acid, nor more than 10 per cent of stems and harmless foreign material.

33. Mustard seed is the seed of *Sinapis alba* L. (white mustard), *Brassica nigra* (L.) Koch (black mustard), *B. juncea* (L.) Cosson, or varieties or closely related species of the types of *B. nigra* and *B. juncea.*

Sinapis alba (white mustard) contains no appreciable amount of volatile oil. It contains not more than 5 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

Brassica nigra (black mustard) and *B. juncea* yield 0.6 per cent of volatile mustard oil (calculated as allylisothiocyanate and determined by the method given in Service and Regulatory Announcements, Chemistry 20). The varieties and species closely related to the types of *B. nigra* and *B. juncea* yield not less than 0.6 per cent of volatile mustard oil, similar in character and composition to the volatile oils yielded by *B. nigra* and *B. juncea.* These mustard seeds contain not more than 5 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

34. Ground mustard seed, mustard meal, is the unbolted, ground mustard seed and conforms to the standards for mustard seed.

35. Mustard cake is ground mustard seed, mustard meal, from which a portion of the fixed oil has been removed.

36. Mustard flour, ground mustard, "mustard," is the powder made from mustard seed with the hulls largely removed and with or without the removal of a portion of the fixed oil. It contains not more than 1.5 per cent of starch, nor more than 6 per cent of total ash.

37. Prepared mustard is a paste composed of a mixture of ground mustard seed and/or mustard flour and/or mustard cake, with salt, a vinegar, and with or without sugar (sucrose), spices, or other condiments. In the fat, salt, and sugar free solids it contains not more than 24 per cent of carbohydrates, not more than 12 per cent of crude fiber, nor less than 5.6 per cent of nitrogen, the carbohydrates being calculated as starch.

38. Nutmeg is the dried seed of *Myristica fragrans* Houtt, deprived of its testa, with or without a thin coating of lime (CaO). It contains not less than 25 per cent of nonvolatile ether extract, not more than 10 per cent of crude fiber, not more than 5 per cent of total ash, nor more than 0.5 per cent of ash insoluble in hydrochloric acid.

39. Macassar nutmeg, Papua nutmeg, male nutmeg, long nutmeg, is the dried seed of *Myristica argentea* Warb., deprived of its testa.

40. Paradise seed, grains of paradise, Guinea grains, melegueta pepper, is the seed of *Amomum melegueta* Roscoe.

41. Parsley leaves are the leaves of *Petroselinum hortense* Hoffm. (*P. sativum* Hoffm.)

42. Black pepper is the dried immature berry of *Piper nigrum* L. It contains not less than 6.75 per cent of nonvolatile ether extract, not less than 30 per cent of starch, not more than 7 per cent of total ash, nor more than 1.5 per cent of ash insoluble in hydrochloric acid.

43. Ground black pepper is the product made by grinding the entire berry of *Piper nigrum* L. It contains the several parts of the berry in their normal proportions.

44. Long pepper is the dried fruit of *Piper longum* L.

45. White pepper is the dried mature berry of *Piper nigrum* L. from which the outer coating or the outer and inner coatings have been removed. It contains not less than 7 per cent of nonvolatile ether extract, not less than 52 per cent of starch, not more than 5 per cent of crude fiber, not more than 3.5 per cent of total ash, nor more than 0.3 per cent of ash insoluble in hydrochloric acid.

46. Saffron is the dried stigma of *Crocus sativus* L. It contains not more than 10 per cent of yellow styles and other foreign matter, not more than 14 per cent of volatile matter when dried at 100° C., not more than 7.5 per cent of total ash, nor more than 1 per cent of ash insoluble in hydrochloric acid.

47. Sage is the dried leaf of *Salvia officinalis* L. It contains not less than 1 per cent of volatile ether extract, not more than 25 per cent of crude fiber, not more than 10 per cent of total ash, nor more than 1 per cent of ash insoluble in hydrochloric acid.

48. Savory, summer savory, is the dried leaf and flowering tops of *Satureja hortensis* L.

49. Star aniseed is the dried fruit of *Illicium verum* Hook. It contains not more than 5 per cent of total ash.

50. Tarragon is the dried leaves and flowering tops of *Artemisia dracunculus* L.

51. Thyme is the dried leaves and flowering tops of *Thymus vulgaris* L. It contains not more than 14 per cent of total ash, nor more than 4 per cent of ash insoluble in hydrochloric acid.

b. Flavoring Extracts

1. A flavoring extract [1] is a solution in ethyl alcohol of proper strength of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its coloring matter, and conforms in name to the plant used in its preparation.

2. Almond extract is the flavoring extract prepared from oil of bitter almonds, free from hydrocyanic acid, and contains not less than 1 per cent by volume of oil of bitter almonds.

2a. Oil of bitter almonds, commercial, is the volatile oil obtained from the seed of the bitter almond (*Amygdalus communis* L.), the apricot (*Prunus armeniaca* L.), or the peach (*Amygdalus persica* L.).

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[1] The flavoring extracts herein described are intended solely for food purposes and are not to be confounded with similar preparations described in the Pharmacopœia for medicinal purposes.

3. Anise extract is the flavoring extract prepared from oil oif anise, and contains not less than 3 per cent by volume of oil of anise.

3*a*. Oil of anise is the volatile oil obtained from the anise seed.

4. Celery seed extract is the flavoring extract prepared from celery seed or the oil of celery seed, or both, and contains not less than 0.3 per cent by volume of oil of celery seed.

4*a*. Oil of celery seed is the volatile oil obtained from celery seed.

5. Cassia extract is the flavoring extract prepared from oil of cassia, and contains not less than 2 per cent by volume of oil of cassia.

5*a*. Oil of cassia is the lead-free volatile oil obtained from the leaves or bark of *Cinnamomum cassia* (L.) Blume, and contains not less than 80 per cent by volume of cinnamic aldehyde.

6. Cinnamon extract is the flavoring extract prepared from oil of cinnamon, and contains not less than 2 per cent by volume of oil of cinnamon.

6*a*. Oil of cinnamon is the lead-free volatile oil obtained from the bark of the Ceylon cinnamon (*Cinnamomum zeylanicum* Nees), and contains not less than 65 per cent by weight of cinnamic aldehyde and not more than 10 per cent by weight of eugenol.

7. Clove extract is the flavoring extract prepared from oil of cloves, and contains not less than 2 per cent by volume of oil of cloves.

7*a*. Oil of cloves is the lead-free volatile oil obtained from cloves.

8. Ginger extract is the flavoring extract prepared from ginger, and contains in each 100 cubic centimeters the alcohol-soluble matters from not less than 20 grams of ginger.

9. Lemon extract is the flavoring extract prepared from oil of lemon, or from lemon peel, or both, and contains not less than 5 per cent by volume of oil of lemon.

9*a*. Oil of lemon is the volatile oil obtained, by expression or alcoholic solution, from the fresh peel of the lemon (*Citrus limonia* Osbeck), has an optical rotation (25° C.) of not less than +60° in a 100-millimeter tube, and contains not less than 4 per cent by weight of citral.

10. Terpeneless extract of lemon is the flavoring extract prepared by shaking oil of lemon with dilute alcohol, or by dissolving terpeneless oil of lemon in dilute alcohol, and contains not less than 0.2 per cent by weight of citral derived from oil of lemon.

10*a*. Terpeneless oil of lemon is oil of lemon from which all or nearly all of the terpenes have been removed.

11. Nutmeg extract is the flavoring extract prepared from oil of nutmeg, and contains not less than 2 per cent by volume of oil of nutmeg.

11*a*. Oil of nutmeg is the volatile oil obtained from nutmegs.

12. Orange extract is the flavoring extract prepared from oil of orange, or from orange peel, or both, and contains not less than 5 per cent by volume of oil of orange.

12*a*. Oil of orange is the volatile oil obtained, by expression or alcoholic solution, from the fresh peel of the orange (*Citrus auratium* L.), and has an optical rotation (25° C.) of not less than +95° in a 100-millimeter tube.

13. Terpeneless extract of orange is the flavoring extract prepared by shaking oil of orange with dilute alcohol, or by dissolving terpeneless oil of orange in dilute alcohol, and corresponds in flavoring strength to orange extract.

13*a*. Terpeneless oil of orange is oil of orange from which all or nearly all of the terpenes have been removed.

14. Peppermint extract is the flavoring extract prepared from oil of peppermint, or from peppermint, or both, and contains not less than 3 per cent by volume of oil of peppermint.

14*a*. Peppermint is the leaves and flowering tops of *Mentha piperita* L.

14*b*. Oil of peppermint is the volatile oil obtained from peppermint, and contains not less than 50 per cent by weight of menthol.

15. Rose extract is the flavoring extract prepared from attar of roses, with or without red rose petals, and contains not less than 0.4 per cent by volume of attar of roses.

15*a*. Attar of roses is the volatile oil obtained from the petals of *Rosa damascena* Mill., *R. centifolia* L., or *R. moschata* Herrm.

16. Savory extract is the flavoring extract prepared from oil of savory, or from savory, or both, and contains not less than 0.35 per cent by volume of oil of savory.

16*a*. Oil of savory is the volatile oil obtained from savory.

17. Spearmint extract is the flavoring extract prepared from oil of spearmint, or from spearmint, or both, and contains not less than 3 per cent by volume of oil of spearmint.

17*a*. Spearmint is the leaves and flowering tops of *Mentha spicata* L.

17*b*. Oil of spearmint is the volatile oil obtained from spearmint.

18. Star anise extract is the flavoring extract prepared from oil of star anise, and contains not less than 3 per cent by volume of oil of star anise.

18*a*. Oil of star anise is the volatile oil distilled from the fruit of the star anise (*Illicium verum* Hook.).

19. Sweet basil extract is the flavoring extract prepared from oil of sweet basil, or from sweet basil, or both, and contains not less than 0.1 per cent by volume of oil of sweet basil.

19*a*. Sweet basil, basil, is the leaves and tops of *Ocimum basilicum* L.

19*b*. Oil of sweet basil is the volatile oil obtained from basil.

20. Sweet marjoram extract, marjoram extract, is the flavoring extract prepared from the oil of marjoram, or from marjoram, or both, and contains not less than 1 per cent by volume of oil of marjoram.

20*a*. Oil of marjoram is the volatile oil obtained from marjoram.

21. Thyme extract is the flavoring extract prepared from oil of thyme, or from thyme, or both, and contains not less than 0.2 per cent by volume of oil of thyme.

21*a*. Oil of thyme is the volatile oil obtained from thyme.

22. Tonka extract is the flavoring extract prepared from tonka bean, with or without sugar or glycerin, and contains not less than 0.1 per cent by weight of coumarin extracted from the tonka bean, together with a corresponding proportion of the other soluble matters thereof.

22*a*. Tonka bean is the seed of *Coumarouna odorata* Aublet (*Dipteryx odorata* (Aubl.) Willd.).

23. Vanilla extract is the flavoring extract prepared from vanilla bean, with or without sugar or glycerin, and contains in 100 cubic centimeters the soluble matters from not less than 10 grams of the vanilla bean.

23*a*. Vanilla bean is the dried, cured fruit of *Vanilla fragrans* (Salisb.) Ames (*V. planifolia* Andr.).

24. Wintergreen extract is the flavoring extract prepared from oil of wintergreen, and contains not less than 3 per cent by volume of oil of wintergreen.

24*a*. Oil of wintergreen is the volatile oil distilled from the leaves of *Gaultheria procumbens* L.

c. Edible Vegetable Oils and Fats

1. Edible fats and edible oils are such glycerids of the fatty acids as are recognized to be wholesome foods. They are dry, and sweet in flavor and odor.

2. Caçao butter, cocoa butter, is the edible fat obtained from sound cacao beans (seeds of *Theobroma cacao* L. or other closely related species), either before or after roasting.

3. Coconut oil, copra oil, is the edible oil obtained from the kernels of the coconut (*Cocos nucifera* L. or *C. butyracea* L.)

4. Cochin oil is coconut oil prepared in Cochin (Malabar).

5. Ceylon oil is coconut oil prepared in Ceylon.

6. Corn oil, maize oil, is the edible oil obtained from the germ of Indian corn, maize (*Zea mays* L.).

7. Cottonseed oil is the edible oil obtained from the seed of the cotton plant (*Gossypium herbaceum* L.), or from the seed of other species of Gossypium.

8. Olive oil, sweet oil, is the edible oil obtained from the sound, mature fruit of the olive tree (*Olea europaea* L.).

9. Palm kernel oil is the edible oil obtained from the kernels of the fruit of the Palm tree (*Elaeis guineensis* Jacq., or *E. melanococca* Gaert.).

10. Peanut oil, arachis oil, earthnut oil, is the edible oil obtained from the peanut (*Arachis hypogaea* L.).

11. Poppy seed oil is the edible oil obtained from the seeds of the poppy (*Papaver somniferum* L.).

12. Rapeseed oil, rape oil, colza oil, is the edible oil obtained from the seed of the rape plant (*Brassica napus* L)., or from the seed of closely related Brassica species which yield oils similar in composition and character to the oil obtained from the seed of *B. napus* L.

13. Soy-bean oil, soy oil, soja oil, is the edible oil obtained from the seed of the soy-bean plant (*Soja max.* (L.) Piper; *Glycine soja* Sieb. & Zucc.; *Soja hispida* Moench).

14. Sesame oil, gingilli oil, teel oil, benne oil, is the edible oil obtained from the seed of the sesame plant (*Sesamum orientale* L.; *S. indicum* L.; *S. radiatum* Schum. and Thonn.).

15. Sunflower oil is the edible oil obtained from the seed of the sunflower (*Helianthus annuus* L.)

H. VINEGAR

1. Vinegar, cider vinegar, apple vinegar, is the product made by the alcoholic and subsequent acetous fermentations of the juice of apples, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

2. Wine vinegar, grape vinegar; is the product made by the alcoholic and subsequent acetous fermentations of the juice of grapes, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

3. Malt vinegar is the product made by the alcoholic and subsequent acetous fermentations, without distillation, of an infusion of barley malt or cereals whose starch has been converted by malt, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

4. Sugar vinegar is the product made by the alcoholic and subsequent acetous fermentations of solutions of sugar, sirup, molasses, or refiners' sirup, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

5. Glucose vinegar is the product made by the alcoholic and subsequent acetous fermentations of solutions of starch sugar or glucose, is dextrorotatory, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

6. Spirit vinegar, distilled vinegar, grain vinegar, is the product made by the acetous fermentation of dilute distilled alcohol, and contains, in 100 cubic centimeters (20° C.), not less than 4 grams of acetic acid.

III. SALT

1. Table salt, dairy salt, is fine-grained crystalline salt containing, on a water-free basis, not more than 1.4 per cent of calcium sulphate ($CaSO_4$), not more than 0.5 per cent of calcium and magnesium chlorides ($CaCl_2$ and $MgCl_2$), nor more than 0.1 per cent of matters insoluble in water.

Pending further announcement, no exception will be taken by the Food, Drug, and Insecticide Administration to table salt that meets the requirements of the standard except that it contains anhydrous calcium sulphate (anhydrite) in excess of 0.1 per cent, provided that the total calcium sulphate content does not exceed 1.4 per cent.

IV. BAKING POWDER

Baking powder is the leavening agent produced by the mixing of an acid-reacting material and sodium bicarbonate, with or without starch or flour.

It yields not less than 12 per cent of available carbon dioxide.

The acid-reacting materials in baking powder are: (1) Tartaric acid or its acid salts, (2) acid salts of phosphoric acid, (3) compounds of aluminum, or (4) any combination in substantial proportions of the foregoing.

United States Department of Agriculture*

FOOD, DRUG, AND INSECTICIDE ADMINISTRATION

SERVICE AND REGULATORY ANNOUNCEMENTS

Food and Drug No. 1

REGULATIONS FOR THE ENFORCEMENT OF THE FEDERAL FOOD AND DRUGS ACT

(Ninth revision)

INTRODUCTION

The accompanying rules and regulations for the enforcement of the food and drugs act of June 30, 1906, as amended, supersede those previously promulgated.

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* S. R. A., F. D. No. 1; Issued October, 1927.

By an act of Congress making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1928, and for other purposes (44 Stat. 1003), approved January 18, 1927, it was provided that the examination of foods and drugs, formerly made in the Bureau of Chemistry, should be made in the Food, Drug, and Insecticide Administration.

These regulations are identical with those of the eighth revision, issued August 7, 1922, except for the substitution of the words "Food, Drug, and Insecticide Administration" for the words "Bureau of Chemistry" wherever they appear.

W. M. Jardine,
Secretary of Agriculture.

Washington, D.C., *August 29, 1927.*

EXTRACTS FROM ABOVE CIRCULAR

RULES AND REGULATIONS FOR THE ENFORCEMENT OF THE FOOD AND DRUGS ACT OF JUNE 30, 1906, AS AMENDED

Regulation 1.—Short Title of the Act

The act, " For preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," approved June 30, 1906 (34 Stat. 768), as amended by the act approved August 23, 1912 (37 Stat. 416), by the act approved March 3, 1913 (37 Stat. 732), by the act approved March 4, 1913 (37 Stat. 736), by the act approved July 24, 1919 (41 Stat. 271), by the act approved January 18, 1927 (44 Stat. 1003), and as it may be amended hereafter, shall be known and referred to as the Federal food and drugs act.

Regulation 2.—Scope of the Act

The provisions of the act apply to foods and to drugs which have been shipped or delivered for shipment in interstate commerce, or which are exported or offered for export to foreign countries, or which are being transported in interstate commerce for sale or have been transported in interstate commerce, or which have been received from a foreign country, or which are manufactured, sold, or offered for sale in the District of Columbia, Territories of the United States, or insular possessions.

Regulation 9.—Confectionery

(Section 7)

The term " food " includes articles used for confectionery. The provisions of the act relating to food, as well as the specific provisions relating to confectionery, apply to confectionery.

Regulation 10.—Powdered

(Section 7, paragraph fourth, in the case of food)

An article of food shall neither be covered with a powder nor reduced to a powder in such manner that damage or inferiority is concealed.

Regulation 11.—Poisonous or Deleterious Ingredients

(Section 7, paragraph fifth, in the case of food)

A poisonous or other deleterious ingredient shall not be added to an article of food in such quantity as may by any possibility render the article injurious to health. Any ingredient artificially introduced into an article of food is an added ingredient.

Regulation 12.—External Application of Preservatives

(Section 7, proviso of paragraph fifth, in the case of food)

A food to which a preservative is applied externally, in order to be within the proviso of section 7, paragraph fifth, must bear on the covering or package directions for the effective removal of such preservative.

Regulation 13.—Colors and Preservatives

(Section 7, in the case of food)

(*a*) Only harmless colors and harmless preservatives may be used in articles of food.

(*b*) A color, preservative, or other substance, even though harmless, shall not be used in the preparation of any article of food in a manner whereby damage or inferiority is concealed.

(*c*) The Secretary of Agriculture shall determine from time to time the wholesomeness of colors, preservatives, and other substances which are added to foods, and shall make public announcement in such manner as he may deem appropriate of the results of the investigations. When so published the results of the investigation shall serve as a guide in enforcing the act.

(*d*) The Secretary of Agriculture may authorize the certification of colors found by him to be in compliance with the law and these regulations.

Regulation 14.—Label

(Section 8)

(*a*) The term "label," as used in the act, includes any legend and descriptive matter or design appearing upon the article or its container, and also includes circulars, pamphlets, and the like which are packed and go with the article to the purchaser, and such letters, circulars, and pamphlets to which reference is made either on the label attached to the package or on the package itself.

(*b*) The label shall bear, plainly and conspicuously displayed, all the information specifically required by the act, e. g., the quantity of the contents of food in package form, in accordance with regulation 26, and the quantity or proportion of the drugs named in section 8 of the act, in accordance with regulations 24 and 25. The label shall also bear such other descriptive matter as the character of the product may require.

(*c*) A label in a foreign language shall conform to these regulations and shall bear all the information required by the act in English, as well as in each of the foreign languages used to describe the article of food or drugs.

(*d*) The label shall be free from any statement, design, or device regarding the article or the ingredients or substances contained therein, or quality thereof, or place of origin, which is false or misleading in any particular. The terms "design" and "device" include pictorial matter of every description, abbreviations, characters, and signs.

(*e*) A food or drug product shall not be labeled or branded in such a manner as to deceive or mislead the purchaser. Direct misstatements and indirect misrepresentations regarding the article or its ingredients by means of designs, printed testimonials, devices, or artifices in the arrangement, style, or dress of the package, or in the arrangement of the printed or pictorial matter in or upon the label or package are prohibited.

(*f*) An article containing more than one food product or active medicinal agent is misbranded if named after a single constituent. In the case of drugs the nomenclature employed by the United States Pharmacopœia and the National Formulary shall obtain.

(*g*) The statement of the formula is not required on the label except in so far as may be necessary to prevent adulteration or misbranding.

(*h*) An article so labeled as to convey the impression that all of its ingredients are declared is misbranded if the list of ingredients is incomplete.

Regulation 15.—When Label is Required

(Section 8)

The use of a label is not compulsory except in the following cases:

(*a*) Imitations (regulation 20, *a*).

(*b*) Foods and drugs containing the ingredients mentioned in section 8, paragraph second, in the case of drugs, and paragraph second, in the case of foods (regulations 24 and 25).

(*c*) Drugs which fall within the proviso of section 7, paragraph first, in the case of drugs (regulation 8, *b*).

(*d*) Foods in package form (regulation 26).

(*e*) Compounds and blends which are brought within the proviso of section 8, paragraph fourth, in the case of foods (regulations 19 and 20).

(*f*) Substitution (regulation 21).

(*g*) Foods which fall within the proviso of section 7, paragraph fifth, in the case of food (regulation 12).

(*h*) By-product or waste material (regulation 22).

(*i*) Articles intended for export which fall within the proviso of section 2 of the act (regulation 27, *b*).

(*j*) Articles which require specific labeling to avoid adulteration or misbranding.

Regulation 16.—Name and Address of Manufacturer

(Section 8)

(*a*) The name of the manufacturer or producer need not be given upon the label, but if given it must be the true name. The words "Packed for ———," "Distributed by ———," or some equivalent phrase, shall be added to the label in case the name which appears upon the label is not that of the actual manufacturer or producer.

(*b*) The place of manufacture or production need not be given upon the label except where, in order to avoid misbranding, it is necessary to indicate clearly that the article is of domestic and not foreign origin, and also in the case of mixtures and compounds sold under their own distinctive names (regulation 19), to bring the articles within the terms of the proviso of section 8, paragraph fourth, of the act.

(*c*) The place of manufacture or production, if given, must be correctly stated.

(*d*) When a person, firm, or corporation actually manufactures or produces a food or a drug in two or more places, the actual place of manufacture or production of each particular package need not be stated on the label except when the mention of any place, to the exclusion of the others, deceives or misleads.

Regulation 17.—Character of Name

(Section 8)

(*a*) A simple or unmixed food or drug product shall be sold by its common name in the English language; or, if a drug recognized in the United States Pharmacopæia or National Formulary, by the name or names therein designated.

(*b*) A geographical name indicating that a food or drug product was manufactured or produced in a specific place shall not be used unless such product was manufactured or produced in that place.

(*c*) A name which is distinctive of a product of a specific foreign country shall not be used upon an article not manufactured or produced in that country, except as an indication of the type or style of quality or manufacture, and then only when the product possesses substantially the characteristic qualities of the product of that foreign country. Such name shall be so qualified as to remove any impression that the article was manufactured or produced in the country in which the name is distinctive.

Regulation 18.—" Distinctive Name " and " Own Distinctive Name "

(Section 8)

(*a*) A " distinctive name " is a name that distinguishes one kind of food from another.

(*b*) The expression " own distinctive name " as used in section 8, paragraph fourth, means a name which is purely arbitrary or fanciful and distinguishes a particular article of food from all other articles of food. It shall not give a false indication of origin, character, composition, ingredients, or place of manufacture, and shall not lead the purchaser to suppose that the product is other than what it is.

Regulation 19.—Mixtures or Compounds with Distinctive Names

(Section 8, paragraph fourth, in the case of food, subparagraph first)

(*a*) The terms " mixtures " and " compounds " are interchangeable.

(*b*) Mixtures or compounds with distinctive names shall not be imitations of other articles, whether simple, mixed, or compound, or offered for sale under the names of other articles. In addition to the distinctive name, they shall bear on the same label or brand the name of the place of manufacture or production. If the name of the place be one which is found in different States, Territories, or counties, the name of the State, Territory, or country, as well as the name of the place, must be stated.

(*c*) An article of food is not within the terms of the proviso of section 8, paragraph fourth, subparagraph first, unless it is labeled in accordance with this regulation.

Regulation 20.—Imitations, Blends, Compounds without Distinctive Names

(Section 8, paragraph first, in the case of food, and paragraph fourth, in the case of food, subparagraph second)

(*a*) An imitation shall bear on the label the word " imitation," and, in addition, a clear statement of the principal or essential ingredients of the article.

(*b*) Compounds and blends, in order to be within section 8, paragraph fourth, in the case of food, subparagraph second, shall bear on the label the word " compound " or " blend," as the case may be, and, in addition, a clear statement of the principal or essential ingredients of the article.

Regulation 21.—Substitution

(Sections 7 and 8)

When a substance of a recognized quality commonly used in the preparation of a food product is replaced in whole or in part by another substance not injurious or deleterious to health, the name of the substitute shall appear upon the label.

Regulation 22.—By-product or Waste Food Material

(Sections 7 and 8)

A food which consists in whole or in part of sound by-product or waste food material, such as pieces, stems, trimmings, and the like, shall not be labeled with the unqualified name of the substance from which such material is derived.

Regulation 23.—Certain Adulterations not Corrected by Label

(Section 7)

Proper labeling alone will not remove an article from the operation of the law. Certain forms of adulteration, e. g., the addition of a poisonous or deleterious ingredient which may render the article injurious to health, can not be corrected by any form of labeling.

Regulation 26.—Statement of Weight, Measure, or Count

(Section 8, paragraph third, in the case of food)

(*a*) Except as otherwise provided by this regulation, a package of food shall be plainly and conspicuously marked with the quantity of the contents in terms of weight, measure, or numerical count on the outside of the container, or of the covering of the package usually delivered to the consumer.

(*b*) The quantity of the contents so marked shall be the quantity of food in the package.

(*c*) The statement of the quantity of the contents shall be plain and conspicuous, shall not be a part of or obscured by any legend or design, and shall be so placed and in such characters as to be readily seen and clearly legible when the size of the package and the circumstances under which it is ordinarily examined by purchasers or consumers are taken into consideration.

(*d*) The quantity of the contents when stated by weight or measure shall be marked in terms of the largest unit contained in the package, except that, in the case of an article with respect to which there exists a definite trade custom for marking the quantity of the article in terms of fractional parts of larger units, it may be so marked in accordance with the custom. Common fractions shall be reduced to their lowest terms; fractions expressed as decimals shall be preceded by zero and shall be carried out to not more than two places.

(*e*) Statement of weight shall be in terms of the avoirdupois pound and ounce; statement of liquid measure shall be in terms of the United States gallon of 231 cubic inches and its customary subdivisions, i.e., gallons, quarts, pints, or fluid ounces, and shall express the volume of the liquid at 68° F. (20° C.); statement of dry measure shall be in terms of the United States standard bushel of 2150.42 cubic

inches and its customary subdivisions, i. e., bushels, pecks, quarts, or pints, or, in the case of articles in barrels, in terms of the United States standard barrel and its lawful subdivisions, i. e., third, half, or three-quarters barrel, as fixed by the act of March 4, 1915 (38 Stat. 1186): *Provided*, That statement of quantity may be in terms of metric weight or measure. Statement of metric weight shall be in terms of kilograms or grams. Statement of metric measure shall be in terms of liters or cubic centimeters. Other terms of metric weight or measure may be used if it appears that a definite trade custom exists for marking articles with such other terms and the articles are marked in accordance with the custom.

(*f*) The quantity of solids shall be stated in terms of weight and the quantity of liquids in terms of measure, except that in case of an article in respect to which there exists a definite trade custom otherwise the statement may be in terms of weight or measure in accordance with such custom. The quantity of viscous or semisolid foods or of mixtures of solids and liquids may be stated either by weight or measure, but the statement shall be definite and shall indicate whether the quantity is expressed in terms of weight or measure, as, for example, " weight 12 oz." or " 12 oz. avoirdupois," " volume 12 ounces " or " 12 fluid ounces."

(*g*) The quantity of the contents shall be stated in terms of weight or measure unless the package is marked by numerical count and such numerical count gives accurate information as to the quantity of the food in the package.

(*h*) The quantity of the contents may be stated in terms of minimum weight, minimum measure, or minimum count, for example, " minimum weight 10 oz.," " minimum volume 1 gallon," or " not less than 4 fl. oz.," but in such case the statement must approximate the actual quantity and there shall be no tolerance below the stated minimum.

(*i*) The following tolerances and variations from the quantity of the contents marked on the package shall be allowed:

(1) Discrepancies due exclusively to errors in weighing, measuring, or counting which occur in packing conducted in compliance with good commercial practice.

(2) Discrepancies due exclusively to differences in the capacity of bottles and similar containers, resulting solely from unavoidable difficulties in manufacturing such bottles or containers so as to be of uniform capacity: *Provided*, That no greater tolerance shall be allowed in case of bottles or similar containers which, because of their design, can not be made of approximately uniform capacity than is allowed in case of bottles or similar containers which can be manufactured so as to be of approximately uniform capacity.

(3) Discrepancies in weight or measure due exclusively to differences in atmospheric conditions in various places and which unavoidably result from the ordinary and customary exposure of the packages to evaporation or to the absorption of water.

Discrepancies under classes (1) and (2) of this paragraph shall be as often above as below the marked quantity. The reasonableness of discrepancies under class (3) of this paragraph will be determined on the facts in each case.

(*j*) A package containing one-half avoirdupois ounce of food or less is " small " and shall be exempt from marking in terms of weight.

(*k*) A package containing one fluid ounce of food or less is " small " and shall be exempt from marking in terms of measure.

(*l*) When a package is not required by paragraph *g* to be marked in terms of either weight or measure and the units of food therein are six or less, it shall, for the purpose of this regulation, be deemed " small " and shall be exempt from marking in terms of numerical count.

INDEX

Q

R